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The Rainbow Mill, Oregon

By W. M. Dake, Jr.*

SYNOPSIS—A cyanide mill equipped for all-slime treatment and using Pachuca tanks for agitation. The usual features accompanying such a mill are present. Zinc-dust precipitation is practiced, the melting being done in oil-fired tilting furnaces. Extraction reaches 95.6% of the original ore content. The ore is quartz and andesite carrying gold.

The Rainbow mine is situated in the eastern part of Oregon, 23 miles southwest of Huntington and 40 miles southeast of Baker, in the Mormon Basin.

The property was located by a native of the Basin about 15 years ago, and a three-stamp mill was erected and operated intermittently for several years. The property changed hands in 1901, and a two-stamp mill was built nearer the mine for the purpose of sampling and testing the ore.

In 1906 an operating company was formed, and 7 two-stamp batteries and plates, supplied by an aërial tram of the single-cable type, were installed at a point half a mile from the mine. To this installation was later added a five-stamp battery, and one Wilfley and two Standard concentrators. The mill was operated for four years and made an extraction of from 75 to 80%.

In 1910 a lease was given on the tailings which had been impounded, and a small sand plant was erected by the lessees. This plant was operated with varying success up to the time the property passed under the management of the present company.

The Rainbow Mill, Rye Valley, Oregon

Construction, Buildings and Ore

The construction work was commenced in May, 1912, and the first ore was milled in the latter part of November of the same year.

All buildings are of wood, roofed with corrugated iron. All foundations for machinery and all retaining walls are of concrete. The buildings are heated with steam supplied by a low-pressure boiler on the lower floor of the mill.

The vein matter treated is composed of quartz, with intrusions of andesite and small stringers of gouge. The valuable metal is gold, little silver being present. The specific gravity is 2.70 on ore of average character.

Ore is delivered from the mine through a vertical shaft by a cage carrying 1-ton cars and is trammed 75 ft. to a 5-ton crusher bin, passing over a Fairbanks track scale where the weight is recorded.

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The ore is drawn from the crusher bin over a 10-ft. grizzly, having ¾-in. bars spaced 1 in., to a Denver Engineering Co.'s Blake-type 11x18-in. jaw crusher. The crusher is driven at 300 r.p.m. by a 35-hp. motor.

The fines from the upper half of the grizzly are conveyed by two steel-lined chutes to the front part of the 210-ton battery bin. The ore, which is crushed to pass a 1½-in. ring, falls directly into the battery bin. Manganese-steel jaws are used, the present set having been in use for 18 months. All crushing is done on day-shift work, one man attending to it.

From the battery bin the ore is drawn through rack-and-pinion gates to three Challenge feeders. These feeders were of the old pall-and-ratchet type, but have been converted to the monkey-wrench-grip type to enable a closer feed and to do away with excessive repair costs.

From the feeders the ore falls into three mortars, arranged as one ten-stamp and one five-stamp battery, placed on reinforced-concrete blocks. These mortars were designed for inside amalgamation, which difficulty has been overcome to a certain extent by installing false dies, 6 in. thick.

All stamps are 1050 lb.; the ten-stamp battery dropping 106 per min. through 6¾ in., and the five-stamp battery, 102 per min. through 7 in. Canda cams are used with 6-in. camshafts. Pacific guides are carried on the ten-stamp battery and Hendy-type guides on the five-stamp battery.

Square-opening 4-mesh No. 16 wire screens are used on all batteries, lasting from two to three weeks. The ore is stamped in mill solution averaging 1 lb. KCN and 0.6 lb. protective alkalinity, with a ratio of 3½ solution to 1 of ore. From 2- to 3-in. discharge is maintained on all batteries.

Chrome-steel shoes and dies are used, the shoes wearing from 80 to 90 days and the dies from 100 to 120 days. A 35-hp. motor is belted to the line shaft which drives the batteries. Swinging belt-tighteners are used. The average stamp duty, based on possible running time, is 6.78 tons per stamp per day.

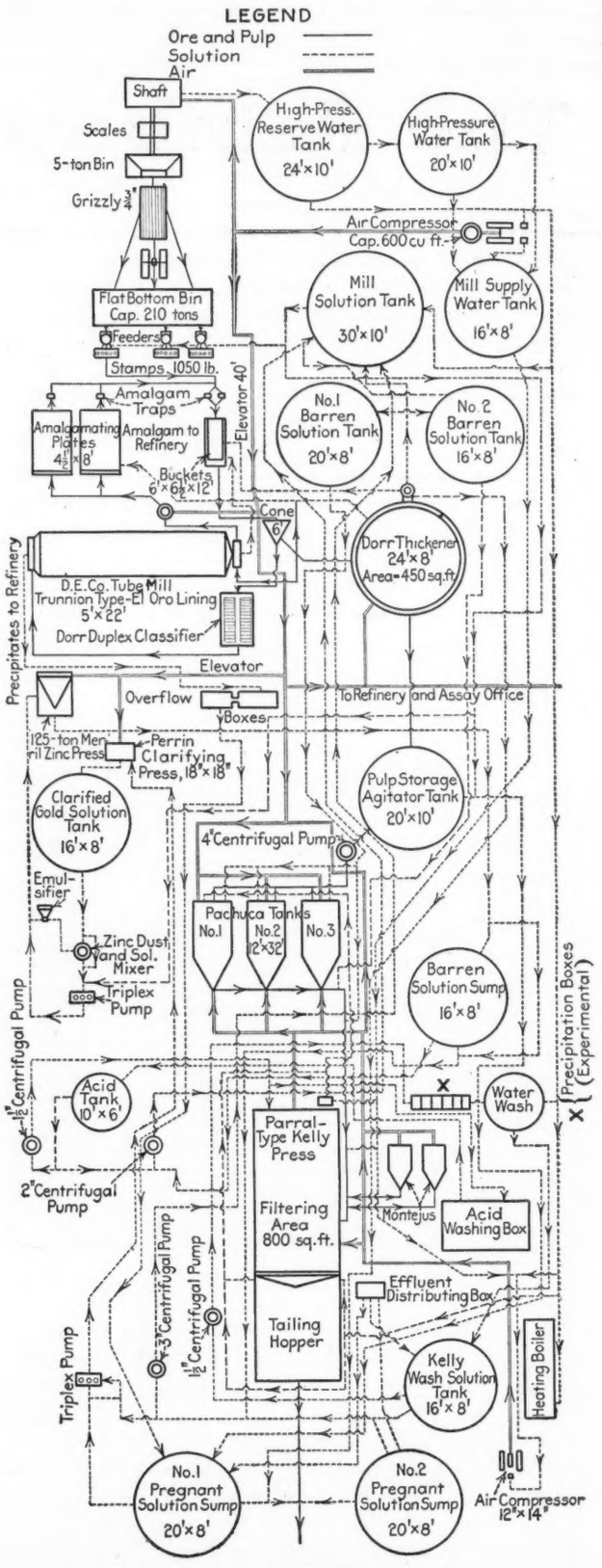
From the batteries the pulp passes to the concrete boot of a 40-ft. elevator equipped with 12x6x5-in. buckets, spaced 10 in. on a 12-in. rubber belt traveling at 300 ft. per min. The average life of the buckets is from three to four months, and of the elevator belt, from five to six months. The pulp is discharged from the elevator into a 5-ft. cone, the overflow of which passes directly to the Dorr thickener. Screen tests on cone overflow average 95% minus-200 mesh. The underflow from the cone is discharged into a Dorr duplex classifier. The slime from the classifier, giving average screen tests of 85.73% minus-200 mesh, 13.68% on 200-mesh and 0.58% on 100-mesh, is sent to the Dorr thickener.

Tube Milling

The sand discharge from the classifier, with 40% moisture, is passed to a Denver Engineering Co.'s trunnion-type 5x22-ft. tube mill with El Oro lining, revolving at 30 r.p.m. and driven by a 75-hp. motor.

It was found that the hard dike material from the mine would serve the purpose of flints, and only one shipment of pebbles was used. The mine rock is broken to pass into the feed dipper, at which point all rock is added. Mine-rock consumption averages 30 lb. per ton of ore milled.

The outside and center end liners, having been cast 1½ in. thick, were found to wear more quickly than the side liners, and it was necessary to change them after six months' use. The second set installed were cast 2½ in. thick, and the thin tongue on each outside end liner,



Flow Sheet of the Rainbow Mill

which was intended to fit between the side liners and the head, was left off. Using this liner, it is not necessary to remove one set of side liners at each end of the mill when replacing outside end liners.

The center end liners were cast of manganese-steel for the feed end of the mill, and a screen with ½-in. openings, was cast 2½ in. thick for the discharge end. The manganese-steel liners have been in use for eight months and show no appreciable wear.

The side liners were changed after 13 months' run. The ones nearest the feed end were discarded, and the remainder—amounting to about 50%—were stored. The complete relining, including unloading, removing old liners, replacing a new set and loading, required 14 hr. When it becomes necessary to reline, a set of side liners will be made up from the two sets of old liners, and from three to four months' run is expected from them. This will give an average of about 15 months' life to each set.

Amalgamation

The tube-mill discharge, showing 78% minus-100 mesh, falls into the suction box of a 4-ft. air lift, where it is diluted to 60% moisture. It is then raised and distributed to two 4½x7-ft. soft-copper plates. The plates are arranged so that the pulp may be switched to either one and are set with a grade of 2¼ in. per ft. Both plates are dressed twice each shift, using fiber brushes, whisk brooms and scrapers cut from rubber belting. It has been found that if the plates are allowed to build up with hard amalgam, the extraction drops off and they are therefore kept as clean as possible.

Plate consumption is rather high, due to the dissolving action of the solution—a plate lasting from three to four months—and for this reason silver-plated plates are not used. There has been no noticeable difference in plate extraction on this account. The copper from the plates is precipitated and is found with the base bullion.

The mill was originally designed for amalgamation following the batteries, and for six months after commencing operations this method was used. Due to the facts that the lime in solution blackened the mercury to such an extent that after three or four hours amalgamation was impossible and that it was necessary to dress the plates at least twice a shift, the stamp-hours lost amounted to 10% of the total running time.

With the idea of increasing tonnage and also amalgamation extraction, tests were made on pulp leaving the tube mill, at a point in the closed classifier circuit where the pulp from the plates would again be elevated to the classifier. It was found that the extraction was increased about 10% by the fine grinding of the tube mill.

As the slime discharge from the Dorr classifier gives a screen test of 99.41% minus-100 mesh, it may be seen that any particle of free gold in the circuit that is too large to dissolve readily in subsequent treatment would be held in the circuit until finally broken up or amalgamated.

By this change the mill tonnage was increased 28%, as it made possible the use of larger-mesh battery screens and decreased the stamp-hours lost to time required for necessary repairs. From the plates, the pulp passes through two amalgam traps into the boot of the elevator and from there into the closed classifier circuit.

The pulp from the Dorr classifier enters the Dorr thickener at about 81% moisture and is there thickened to 1:1 consistency. The clear overflow, titrating 1 lb. KCN and from 0.6 to 0.8 lb. protective alkalinity, is returned by a 3-in. centrifugal pump to the mill-solution tank—30 ft. in diameter by 10 ft. deep—and is there distributed to lines running to the batteries, classifier, tube mill, plates, etc.

The underflow from the thickener is discharged by gravity into the pulp-storage tank, which is equipped with a mechanical agitator revolving at 6 r.p.m. This tank is 20 ft. in diameter by 10 ft. deep and has a capacity of one Pachuca tank.

From this tank the pulp is elevated by a 4-in. centrifugal pump and distributed by pipes to the three 12x30-ft. Pachuca agitators.

These tanks are arranged for intermittent agitation. Air is supplied at 30 lb. pressure from the mill compressor. At the agitators, sodium cyanide is added to bring the solution up to 1.5 lb. KCN per ton. Lead acetate is also added here. The protective alkalinity of the tank charge is regulated by titration of the thickener overflow and addition of lime to the batteries. The charges are given a 12-hr. agitation, resulting in 80% extraction in the tanks. Cyanide consumption is 0.851 lb. NaCN per ton of ore milled. Lime consumption is 8.852 lb., and lead acetate is 0.130 lb. per ton milled.

Filtration

At the end of the agitation period the pulp is drawn through 6-in. pipes from the bottom of the Pachuca tanks to a Parral-type Kelly filter having 10 leaves with a filtering area of 800 sq.ft. The filter is equipped with montejus of sufficient capacity to hold a charge for the press. Monteju pressure for making cake, returning, etc., is supplied from the mill air compressor at 30 lb. The accompanying table shows an average cycle, making a 1¾-in. cake with pulp of 1.4 sp.gr., a total time of 59 minutes.

AVERAGE FILTRATION CYCLE

Filling	2 minutes
Making cake	12 minutes
Returning excess pulp	3 minutes
Washing with solution	16 minutes
Washing with water	6 minutes
Returning excess wash	3 minutes
Drying	5 minutes
Discharging	12 minutes
Total time of cycle	59 minutes

The cake is discharged at 25% moisture and is sluiced through an inclined launder to the tailings dam. Acid washes are given to the leaves in the shell every sixth day, using a 10-lb. solution of muriatic acid. The solution is carried from the acid tank by a 1½-in. centrifugal pump into the water-discharging manifold of the press head, the press filled and the overflow returned to the acid tank. Acid washes are of 2 hr. duration.

In case a leak is found in a leaf, it is removed to an acid-washing tank and a new leaf substituted. The leaky leaf is then acid-washed and scrubbed with fiber brushes, marked, dried, patched and placed in readiness for the next change. With proper care leaves should last for two years.

Precipitation

The solution from the Kelly filter is discharged into a collecting box and from there is run to one of three tanks, two of which are used for high- and medium-value solution and the third for wash water. For the first 20 min. of the filter cycle, the effluent from the press is run into the No. 1 gold tank, 20 ft. in diameter by 8 ft. deep.

During the following 20 min. of the cycle, the solution is run into the No. 2 gold tank, of the same size as No. 1, and is pumped from there by a 3-in. centrifugal pump into the mill-solution tank. The solution from the last part of the cycle is run into the wash-water tank and is returned to the water-wash tank above the filter by a 1½-in. centrifugal pump.

The solution from No. 1 gold tank is drawn off through a 2-in. pipe to a 4x6-in. Goulds triplex pump. This pump forces the solution through a 22-frame, 18x18-in. Perrin clarifying press, fitted with 10-oz. canvas leaves covered with commercial filter paper. By using the paper, the press can be cleaned by one man in 45 min. From the clarifying press, the solution is piped to the clarified-solution tank, 16 ft. in diameter by 8 ft. deep, and is then drawn through a mixing tank, where the zinc-dust emulsion is added, to a 4x6-in. Goulds triplex pump.

This pump forces the solution through a 10-frame Merrill precipitation press carrying 10-oz. canvas leaves, and from there is run to a barren-solution sump 16 ft. in diameter by 8 ft. deep. From this sump the solution is pumped by a 3-in. centrifugal pump to the two barren tanks or into the mill-solution tank at the top of the mill.

Zinc is fed by a Merrill zinc-dust feeder, at 0.25 lb. per ton of solution. Zinc consumption is 0.531 lb. per ton of ore milled.

The Merrill press is cleaned tri-monthly. After the precipitating pump has been shut down, all ports at the bottom of the press are opened, and air at 80 to 90 lb. pressure, supplied from the mine compressor, is turned on for 2 hr. The press is then opened, leaves scraped with spatulas, and the precipitate at 20% moisture falls into sheet-iron pans. Leaves are then examined for leaks, press closed, pans removed and precipitation started. The press is cleaned by two men in less than an hour. Canvas leaves are changed once each month and the old leaves are burned in the retort furnace and the ashes added to the precipitate. Precipitate is carried to the refinery, weighed and fluxed without further drying in a large fluxing box. After it is weighed and the moisture determined, the precipitate is fluxed as shown in the accompanying table:

FLUXING THE PRECIPITATE

	Per Cent.
Dry precipitate	37.8
Borax glass	12.2
Soda	10.8
Niter	8.2
Fluorspar	4.0
Silica	27.0

Fluxed precipitate is charged into a No. 200 Steele-Harvey tilting oil-fired crucible furnace. Oil and air are fed through a Monarch burner at 80 lb. pressure. As the precipitate is melted down, more is added until the crucible is filled to within 3 in. of the top. When zinc fumes cease to be given off—after about 3 hr.—the charge is poured into conical molds. The time of melting for one crucible charge averages 6 hr.

When the preliminary melt has been finished, all buttons are melted in the crucible with borax, soda, a little niter and fluorspar, and the charge is poured into bullion molds.

Molds are cooled, bars turned out and hammered free from slag, scrubbed with weak acid, drill-sampled on top and bottom, stamped with bar number and weight and shipped. The bars average 534 fine.

The average weight of dry precipitate cleaned up is 300 lb. and the average number of crucibles used per melt is 1. An average of four pours is secured from each crucible. All slag from the refinery is crushed, pulverized and ground in a ball mill with strong cyanide solution and mercury, effecting an extraction of 85%.

The amalgam is recovered by panning and is retorted and the sponge added to the precipitate buttons each month. The pulp and solution from the ball mill are piped to the elevator boot and into the mill circuit. Amalgam is checked in to the refiner tri-monthly, retorted in a wood-burning Hendy retort and melted down in the crucible furnace into bars. These bars are sampled, stamped and shipped separately. Amalgam bars average 805 fine.

All scrapped amalgam plates are hammered free from hard amalgam, cut up, folded and melted down in the crucible furnace, poured into conical molds, sampled and shipped to the smelting plant. The average extraction obtained is 95.6%.

Sampling and Assaying

Solution and pulp sampling is attended to by the solution man on each shift. Solution samples are bottled and tagged, and pulp samples cut down and dried in an electric drier and sacked. All samples are entered in the assay report book before being carried to the assay office.

The assay office is about 50 yd. from the mill and consists of four rooms. The crusher room contains a 4x6-in. jaw crusher and a Braun planetary-disk pulverizer driven by a 5-hp. motor; a buck-board, cutting-down floor, Jones samplers, sized screens, etc. The furnace room contains a brick double-muffle oil-fired furnace using a Case low-pressure fan and burner; a cupel machine, sample-filing cases, pulp balances, etc. The solution room is equipped with a hooded hotplate, filter stands, sink, and apparatus for wet determinations. The balance room is fitted with a Thompson analytical balance and a Keller button balance.

All samples from the mine and mill are delivered to the office each morning, and the results are reported by three o'clock in the afternoon.

The average number of fusions per day from the mine is 32, and from the mill, 14. Cupellations average 68 per day. This figure includes 20 solution samples and all bullion assays. Aside from the regular daily samples from mill and mine, all analyses on mill solutions, zinc dust, lime, etc., are made here. Analyses average about 45 determinations per month.

The mill crew consists of three men, a solution man in charge of the shift, a battery man and a filter operator. On day shift there is a crusherman, general millman, refiner, assayer and helper. Total labor, including superintendence, is 15 men.

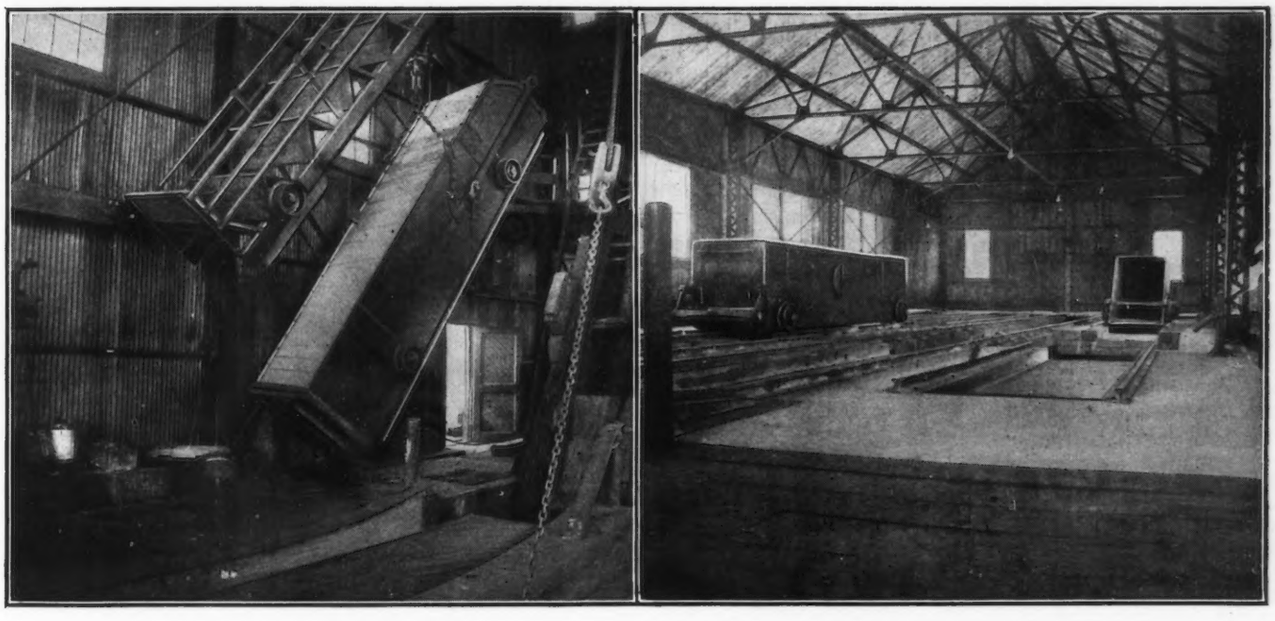
Electric power is supplied from the Idaho-Oregon Light & Power Co. over a 20-mile line from the substation at Gypsum, at 23,000 volts. The power is received at the mine in a transformer house, 200 ft. from the mine buildings, and is carried through three transformers, where it is stepped down to 440 volts, and delivered to the mill through a low-voltage release switch. Current is transformed for lighting purposes to 220- and 110-volt circuits. All motors are equipped with fuse blocks and starting compensators of the low-voltage release type. The average power consumption for total mill operations is 2988 kw.-hr. per day, or 1.23 kw. per ton of ore milled.

Shaft-Rockhouse Practice in the Copper Country--II

By L. Hall Goodwin*

SYNOPSIS—In this installment are described the several operations carried on in the shafthouse, as distinguished from the rockhouse, with the different methods of conducting them. Three skip-dumping devices. Methods of changing shaft conveyances. Duties of the lander. Handling poor rock. Handling timber and steel.

In the deep, low-grade mines of the Copper Country the hoisting problem is exceedingly important. It involves expensive equipment and costly operations, which form a large item in the cost of a pound of copper. It is essential that rock-hoisting operations shall be interfered with as little as possible; the ore skip is referred to as the "moneymaker," and every minute that it is idle means lost revenue. For this reason the shafthouse must be well equipped with devices intended to minimize the time lost in dumping the skip, in substituting the skip for the man-car on the hoisting rope and in similar operations.



Cranes at the Quincy — Storage Tracks at the North Kearsarge

Fig. 4. Devices in the Shafthouse for Changing Shaft Conveyances

Skip-Dumping Devices

All of the skip-dumping devices used in the incline shafts depend upon one general principle—that of allowing the narrow-tread front wheels to take a track which runs downward from the track followed by the broad treads of the rear wheels, thus raising the rear end of the skip with respect to the front end and dumping it.

Originally the front wheels took an auxiliary track running horizontally, while the rear wheels remained on the main track, which continued the inclination of the shaft. Modifications of this simple case have been adopted which need further explanation. In Fig. 5, *A, B, C* and *D* will serve to illustrate diagrammatically the points made in this connection. With the introduction of longer skips of large capacity it was found to be an advantage to raise the rear end of the skip from the main track, as well as to allow the front end to drop away from it—that is, both sets of wheels take auxiliary tracks, one going up, the other down from the main track. This has no advantage over the first system in so far as the operation of dumping is alone concerned, but it is economical of space, since the nose of the skip does not project so far into the dump. The Copper Range Consolidated Co. has gone still farther and has adopted the Angove dump, in which the front wheels remain on the main track, while the rear wheels are lifted away from it by auxiliary rails, the rear wheels thus performing the whole operation of dumping. The Angove dump is applicable to short skips only; it also requires a roller for the nose of the skip to rest on while in a dumping position in order to prevent the skip from turning over completely.

Comparing these three types of dump from the standpoint of operation, the one illustrated in *A*, Fig. 5, is the best, since gravity aids in dumping, and the pull of the engine is less just before the skip reaches a dumping position than at any other time. The Angove dump, shown in *C*, lies at the other extreme, as the engine must exert a considerable additional pull just before the skip dumps.

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This would appear to be a serious disadvantage of the Angove method; but as a matter of fact it causes little trouble. The original dump was undoubtedly the best as far as the operation of dumping is concerned. That it is little used at present is due to the fact that it has been thought best to sacrifice its good qualities to other factors, such as the saving in space noted in the foregoing.

Because of the different products hoisted, it is necessary to have several skip dumps, and these must be placed at different points on the same inclined track. The copper-rock dump is always the highest, and some arrangement must be made to allow the skips to pass over the other dumps. The simplest way of accomplishing this is by the sliding-rail method illustrated in *D*. Sections of the steel plate which forms the skip tracks are cut and made to slide in such a way that when they are open they will not engage the narrow treads of the front wheels but allow them to take the horizontal track. The sliding sections are held in place by pins which pass through them and into the track stringer. At the Quincy mine this method has been elaborated so that the sliding sections are operated by a mechanism controlled by levers in the lander's "shanty." Thus when the underground bell signals indicate that poor rock or mass copper is to be hoisted, the lander simply pulls the proper lever, and no time is lost in changing the dump.

It will be noticed that in the case of the Angove dump, if the tailpiece of the auxiliary rail is made to swing on a pivot at *P* and raised to clear the main wheels, the main track at that point will be entirely free, just as if there were no dump there. This is an excellent feature in the Angove, as it permits a dump to be placed at any point in the main track without cutting the track stringer or otherwise affecting the track in the least.

There are other interesting and ingenious devices for accomplishing this purpose, but a discussion of them is beyond the scope of this paper.

Conveyance-Changing Methods

What might be referred to as the rolling stock consists, at those shafts where hoisting is carried on in balance, of two rock skips and two man-cars. Certain of the deep mines also have water skips, and in a few instances a special skip is used for the purpose of lowering timber. In the ordinary type of shafthouse it is not unusual, therefore, to have six conveyances, and four of these must at all times be stored. It is evidently important that the change from hoisting rope to storage shall be easily and expeditiously made.

Broadly speaking, two methods of storing and changing are employed, as illustrated in Fig. 4. The one most used provides storage capacity in an extension of the shafthouse, or rather what in most cases amounts to a detached building connected with the main building only by the skip tracks. In the usual two-hoisting-compartment shaft this building contains four horizontal tracks for holding the conveyances; two of these tracks are in line with the skip road in the shaft; the other two are blind tracks, one on each side of the two main tracks and parallel to them; they may be connected to the main tracks by switches, but it is more common to transfer cars from one track to another by means of a transfer car running on tracks at right angles to the others, such as is commonly used for transferring cars from one track to another in street-railway carbarns. To transfer the conveyances from the inclined-skip tracks to the horizontal tracks use is made of a short piece of track curved in vertical section, one end of it hinged where it joins the horizontal tracks, the other end being lowered to the main skip tracks whenever a conveyance is to be changed. In changing, the conveyance on the rope is lowered slowly over this curved section to the horizontal tracks. While the operation of changing is performed partly by the hoisting engine, a large amount of time is wasted in transferring the conveyances from one horizontal track to another, since at least one of these operations must be gone through every time a change is made. Another disadvantage is that the tracks and the conveyances stored on them are in the way of any operations which may be carried on in the shafthouse. At many mines in and near Calumet, where the skip tracks at the surface are inclined 40° or flatter, this is the only method applicable, because it would not be practicable to secure in the low shafthouses the overhead clearance necessary for the crane or trolley system. It is also used at some mines of steep dip where the hoisting problem is not all important.

The other system, which is used at shafts having a steep dip and making a large output, suspends the conveyances either on cranes swung from the heavy framing of the sides of the shafthouse or from overhead trolleys running on I-beams carried by the roof trusses. In either case the conveyances are suspended at such a height above the floor of the shafthouse as not to interfere with any work that may need to be done, such as handling timber. This is one of the advantages of the system; the other advantage is the speed with which a change can be made.

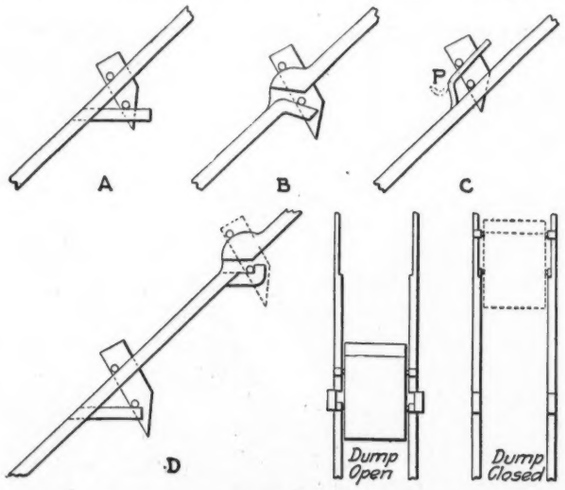


Fig. 5. Types of Inclined Skip Dumps
A, Ordinary dump. B, Combination dump. C, Angove dump. D, Two-point dump

The Copper Range and Ahmeek companies employ trolleys, but their mines have to furnish storage space for only four conveyances, as they do not use water skips. Usually the I-beams, on which the trolley wheels operate, run diagonally out from the shaft; but at certain of the Baltic shafthouses, where the distance between the skip tracks is in the neighborhood of 14 ft., the I-beams run straight across the shafthouse in a line parallel to the plane of the skip tracks. In this case only two I-beams are used. One runs across the whole width of the shafthouse and carries the two man-cars near its extremities at the sides of the shafthouse; the other extends only

over the skip tracks and carries the two skips between the tracks. The operation of substituting the skip for the man-car on the hoisting rope is as follows: The man-car being on the rope, the engineer raises it slightly higher than is necessary, and two hooks on chains carried by the trolley are placed in eyes on the car; the engineer then slowly lowers the car until the chains begin to take its weight, the I-beams being placed at such a distance from the shaft that when the chains carry the whole weight of the car the latter will swing clear of the track; the hoisting rope is then made fast by a special device and the clevis removed from the bail of the car; the car is pulled out of the way by means of a wire rope attached to the trolley and wound on a drum operated on the floor of the shafthouse by hand. The skip is next pulled into position over the track and the clevis is adjusted on it; the engineer hoists carefully so that the hoisting rope slowly takes the weight of the skip, which is guided by the men to hit the rails squarely; the chains are removed from the skip, and the operation is complete.

The Quincy employs cranes, and has to provide six at each shaft—two each for rock skips, water skips and man-cars. This is the only mine using the crane system, the construction of its shafthouses being such that there is not room for the trolleys that would be required to store six conveyances. The cranes have no disadvantage as against trolleys, except perhaps that all of the weight on each crane must be supported by one member of the framing, whereas the I-beam trolleys are carried by the roof trusses and the weight is distributed.

Handling Poor Rock

Handling poor rock is essentially a shafthouse operation, as it has been proved inadvisable to try to sort out much waste rock in the rockhouse. It has been attempted at mines where a large amount of picking is done; but it is easier for the rockhouse men to let the poor rock go through the crusher than to pick it out, and that is what usually happens.

At some mines little poor rock is hoisted to the surface, except during the development stage; but a certain amount of it is always handled. Most of the mines have auxiliary crushing plants to crush waste rock for use about the mine, or for sale for roadmaking and other purposes; but this of course absorbs only a small part of the total amount hoisted. With the large companies it is sometimes the practice to crush all of the poor rock from a certain shaft or shafts and none of it from the others. Thus at the Red Jacket shaft of the Calumet & Hecla all poor rock hoisted is crushed; but as a rule the system is made more flexible so that only the desired amount is crushed at any shaft. The Copper Range Consolidated has a novel method for securing inexpensive crushed rock. At its mines more waste is hoisted than is usual, and provision is always made for dumping it back into old stopes through raises to the surface. The poor rock is trammed over a trestle to these raises from the bin in the shafthouse; when these trestles are of sufficient height, bins are built near their ends, about 6 ft. back from the raise, and 1½-in. grizzlies are so placed that when the waste rock is dumped it slides over the grizzly, the oversize going into the raise, the undersize into the bin, whence it is drawn off as needed. The Copper Range mines also have an excellent method of disposing of waste rock without hoisting it to the surface. The steep dip of its lode enables it to have underground poor dumps back of the shaft which deliver the rock to raises connected with old stopes. Thus at the Baltic No. 3 shaft, which is at present 20 levels deep, the poor dump is located at the 14th level.

This practice of dumping poor rock back into the mine has also been followed by the Calumet & Hecla. All waste which could not be sold as crushed rock was disposed of by hauling it in trains to a raise near Osceola No. 13 shaft, which connects with old stopes. This method will doubtless find a wider application as more of the mines get deep.

Where the surplus poor rock is not dumped back into the mine it is usually feasible to tram it to a poor dump near the shafthouse; this is an advantage when the mine is being developed, as the poor rock may always be used to good purpose in doing necessary, or at least desirable, grading. The accompanying flow sheet, Fig. 6, illustrates a typical method of handling waste at the northern end of the district. The copper-rock dumping plate is hinged

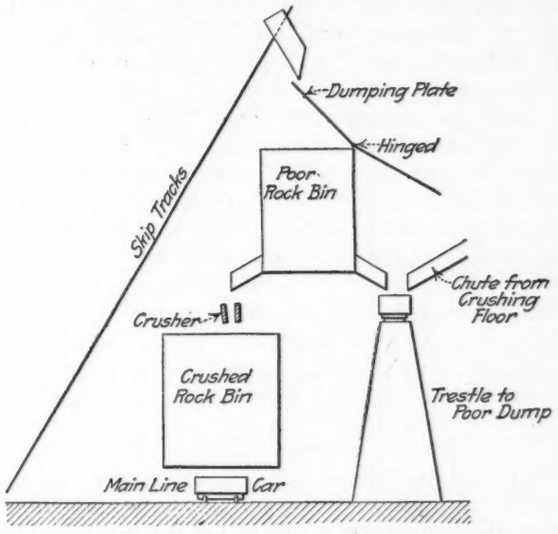


Fig. 6. Flow Sheet for Poor Rock

along its lower edge so that when it is raised the skip discharges directly into a bin; two chutes from this bin deliver to a small tramcar, which is connected by a trestle with the poor-rock dump and to a small crusher. Waste picked out on the crusher floor, consisting of poor rock, broken pieces of timber, etc., is thrown into a chute, which when full is discharged directly into the car. The crushed-rock bin may be kept full at all times and the surplus trammed to the dump. In the later stages of mining operations it is often necessary to haul this material some distance to a suitable dumping place. To adapt this flow sheet to this contingency, it is simply necessary to substitute for the tramcar and trestle another bin alongside the crushed-rock bin which delivers to the main-line cars. Owing to different designs, it is not always possible to use the same skip dump for both copper and poor rock. In this case the poor-rock dump is lower, but otherwise the flow sheet need not be changed.

Handling Timber and Supplies

At some shallow mines with a firm hanging wall, of which the Wolverine may be taken as typical, little timber is used underground, but all deep mines require large quantities of it. At the mines in Calumet special timber

skips are used. These are loaded in the stull yards outside of the shafthouse and transferred to the skip tracks, a small winding engine being used to pull them into the shafthouse. This method is used only where arrangements have been made for readily transferring the skip from the horizontal to the inclined tracks. Where this has not been done the timber is lowered in the regular rock skip. In this case it may be loaded on a larry in the stull yard, then wheeled into the shafthouse and "up-ended," piece by piece, into the skip; or it may be dragged to the door of the shafthouse by horses and then lifted and swung into the skip with a tackle operated by a pony engine in the shafthouse. One advantage of using the rock skip for lowering timber is that an empty timber skip does not have to be hoisted; but rock may be hoisted on the return trip, a point which may not be fully appreciated by those unacquainted with the exigencies of mining at the depth of a mile.

The only item of supplies which merits consideration is drill steel. It is the practice to place sharp steel in racks along the side of the shafthouse, which are numbered to correspond to the several levels. At the Quincy dull drills are placed in a sling underground, the sling consisting of an iron ring 5 in. in diameter, into which the drills are wedged with small wooden wedges. The full slings are thrown into the rock skip, which discharges them automatically at the mass-copper chute just above the collar of the shaft. This chute starts off at a slope of 30° and gradually changes to a horizontal platform, from which the drills are easily loaded into a wagon. At the Copper Range Consolidated mines the drill steel is sent up loose in the man cages, and is loaded directly into a steel box on a wagon in summer or on a sled in winter, each shaft having its own wagon and sled; and its box is always in place to receive the drills.

The Lander

At these mines the engine-houses are set at a distance from the shaft, sometimes as much as 500 ft. For this reason the hoisting engineer cannot see the skip when it dumps, as is the case in some mining districts, and it is customary to have a man in the shafthouse to signal the engineer when the skip has dumped. This man is called the "lander," and his services are considered necessary to the proper operation of the mine. Outside of the above-mentioned duty, however, the field of the lander is varied and his functions differ widely at different mines. It is almost the universal custom for him to relay all of the underground signals, which are transmitted to him either by bell cord or electrically. At a few mines all underground signals go directly to the hoisting engineer, and in such cases there is, properly speaking, no lander, although his prime function is performed by one of the rockhouse men, who signals the engineer when the skip has dumped. The lander is usually stationed in the upper part of the shafthouse, near the copper-rock dump. At a few mines he is near the grizzly, and it is one of his duties to clean down the grizzly after each skip has dumped. At all of those mines where a hopper bin is not used to receive the rock from the skip it is necessary that he give warning to the rockhouse men of the approach of a skip, so that they may get out of the way of flying rock.

At the mines near Portage Lake it is the custom to have the lander's "shanty" near the collar of the shaft—that is, on the ground floor. The lander then attends to the lowering of timber and other supplies; changes the skips on the hoisting ropes and greases them; keeps various records of operations; has in some cases three telephones to attend to, one underground, another to the engineer and the other long distance, and is more of an official in general than is usually the case. At most of the older mines the landers are experienced and responsible men who have at some time worked underground and are acquainted with the underground end of hoisting. They are regarded as a sort of flywheel acting between the underground signals, which may be carelessly rung, and the hoisting engineer, who has troubles enough without being bothered with careless signaling.

At the Superior mine is found, it is believed, the only exception to the rule of having a man whose duty it is to ring a signal to the engineer when the skip has dumped. In its only operating shaft-rockhouse, the skip, as it passes the brace, trips a lever, which blows a whistle in the rockhouse to warn the men of its approach. The hoisting engineer simply goes by the mark on the drum to know when the skip is in a dumping position. Only rarely does it happen that the skip does not dump because of the wedging of large rocks at its mouth. In such cases the rockhouse men ring it back. When men are being lowered, one of the surface hands stands at the brace and acts as a temporary lander.

(To be continued)

Newly Discovered Phosphate Deposit in Tennessee

By Henry V. Maxwell*

A recent discovery of phosphate rock in Johnson County, Tenn., adjacent to the Virginia line, while as yet entirely undeveloped, promises to prove of great importance and value.

By accident, as is frequently the case, Donnelly & Donnelly, attorneys, of Mountain City, Tenn., submitted to a chemist what was supposed to be zinc, but which proved to be phosphate of the very highest grade. I have just traversed the field, and find that the field test of ammonium molybdate moistened with dilute nitric acid shows the ore to exist in immense quantities, covering a wide range of territory. Taking Mountain City as a base, the ore occurs three miles east in the smaller hills of the valley proper, this ore being the result of later origin than that of the general field, and while possibly in smaller deposits than the more massive bodies, is proved by analyses to be of high commercial value. While no prospecting has been done, cropping and surface indications warrant the belief that in this alone profitable operations will result.

Eight miles southwest from this point the ore is encountered in massive stratified bodies, forming one of the layers of the southern slope of Iron Mountain, while from Mountain City, eight miles southwest, the ore is again encountered in massive form, here forming one of the strata of Stone Mountain, the mineral presenting a face of some 30 ft., standing almost vertical, and in its northeast and southwest trend conforms to the strike of the mountain range, but is exposed in a gap through which passes one of the prongs of Roans Creek.

At this point, as shown by Keith's United States geological survey, the granite and quartzite form a contact,

*Butler, Tenn.

while at the first-named point occurs an isolated intrusion of granite, thus creating the impression that owing to unusual metamorphic action noticeable at both points the phosphorus is largely due to that cause.

In the absence of analyses of the separate bodies, no assurance is given that the larger bodies will be of high enough grade for shipment crude, but undoubtedly they will furnish almost limitless quantities of material for grinding, for use in its crude state.

In my opinion, the rock will be found for good distances along the mountain ranges and extending on into Virginia. Much interest is being taken in the field, which will soon result in determining the extent and value of the deposits as yet not analyzed.

Norwegian Copper and Pyrites in 1914

SPECIAL CORRESPONDENCE

The total pyrites production for 1914 in Norway was about 430,000 tons, which was taken from the Sulitelma, Stordoe, Bossmo, Foldal, Roestvangen and Röros mines. Of this amount 358,114 tons was exported, or about 70,000 tons less than during 1913. For home consumption about 60,000 tons was reserved, and 42,852 tons of purple ore was exported. The total amount of metallic copper produced in the country in 1914 was 2867 tons, and if the copper content of the pyrites shipped to Sweden, Germany, England and other countries be included, the copper total would be about 11,000 tons—about 1% of the world's output. The total value of the copper and pyrites at Norwegian ports was about 14,000,000 kroner ($3,752,000). Professor Vogt estimates that the Norwegian pyrites exported is about one-tenth of the total of European shipments. He also estimates the German annual production of copper from Norwegian ores in normal times at 25,500 tons, and that of Austria at 3850 tons.

The total number of men employed in the cupriferous mines in Norway during 1914 was 4250. The profits of the Swedish Sulitelma Aktiebolag for 1914 amounted to 1,638,000 kroner ($438,984), and a dividend of 7% was declared, after 30% had been written off. Owing, however, to this company's large holding in the Swedish Helsingborg copper-extraction works, where the Sulitelma purple ores are dealt with, the actual profits of the company are much higher. In 1913 the net profit of the Helsingborg Kopparverket was 1,132,000 kroner ($303,376), of which only 450,000 kroner ($120,600) was shown on the books as for Sulitelma account; but as Sulitelma owns nearly the whole of the shares the actual net earnings of the Sulitelma company in 1913 was 2,320,000 kroner ($621,760) or 32% of the share capital. Of purple ore 80,000 tons was exported to Helsingborg; of pyrites 125,610 tons was shipped, as against 125,014 tons in 1913; of Elmore concentrates, 13,376 tons, as against 11,472 tons in 1913; and of bessemer copper 1473 tons, as against 1385 tons in the previous year.

Skinner's Mining Manual and Year Book

The first line of the notice of W. R. Skinner's Mining Manual and Year Book which appeared in the JOURNAL of May 15, 1915, p. 870, should have read "for 1915," instead of "for 1914." Elsewhere the book was correctly designated.

The Porphyry Coppers

BY PERCY E. BARBOUR

In the JOURNAL of July 15, 1911, was published a table of the porphyry coppers similar to Table 1 published herewith. At that time the total tonnage of developed and partly developed ore by these large porphyry companies totaled 447 million tons. At this time, four years later, the present table shows this figure to be 1125 million tons. This table, however, includes the Braden and the Chile Copper, both of South America, which were not included in the previous estimate. Deducting these reserves, amounting respectively to 78 million and 303 million, leaves nearly 800 million tons, which is almost double the ore reserves of the companies as given in the table published four years ago. This statement is only approximate, as will be seen by glancing at the table, but is close enough to furnish some very interesting food for thought, viz., that despite the enormous production of the last four years, the ore reserves of these copper mines in this country alone have been practically doubled.

TABLE 1. ORE RESERVES

	Tonnage Developed and Partly Developed	Copper Tenor of Reserves, %	Date of Estimate	Total Copper Contents, Tons	Total Copper Recoverable at 70% Extraction	Nominal Mill Capacity, Tons per Day
Utah Copper..	342,500,000	1.45	12/31/14	4,966,250	3,476,375	21,500
Nevada Con..	41,020,296	1.68	12/31/14	689,141	482,399	9,500
Chino.....	90,270,000	1.75	12/31/14	1,579,725	1,105,808	6,300
Ray Con.....	74,765,789	2.214	12/31/14	1,655,315	1,158,721	6,650
Consolidated Copper Mines *a*....	21,624,236	1.153	4/30/14	249,327	174,529	None
Miami.....	36,500,000*e*	1.85	3/19/15	675,250	472,675	4,200
Inspiration *b*.	97,143,000	1.63	12/31/14	1,583,430	1,266,745*d*	7,500*c*
New Cornelia (C & A)....	40,258,000*g*	1.51		607,896	425,527	4,000*h*
Braden *f*.....	78,000,000	2.5	1/31/14	1,950,000	1,365,000	4,500
Chile.....	303,303,000	2.0	6/1/15	6,066,060	4,246,242	10,000*i*
Totals....	1,125,384,321	1.779		20,022,394	14,174,021	74,150

a. Includes Giroux. *b*. Includes New Keystone and Live Oak. *c*. To be increased to 15,000 tons by end of 1915. *d*. Figured at 80% extraction as indicated by company's experimental flotation mill. *e*. Does not include 6,000,000 tons 2% oxidized ores for which treatment has not yet been worked out. *f*. It is expected that an official report to be issued at an early date will show reserves to be 110,000,000 tons with copper tenor slightly above 2.5%. *g*. Of this total, 11,954,400 tons carbonate ores average 1.54% and 28,303,600 tons sulphide ores average 1.50% copper. *h*. Mill being designed. Treatment worked out. *i*. First unit being tuned up, construction of another 10,000-ton unit in hand.

The ore reserves and their copper tenor are all taken from the annual reports of the various companies except the Braden and the Chile, which figures are from personal communications.

The total tonnage of developed and partly developed ore is 1,125,384,321 tons and contains 20,022,394 tons of copper, which makes the average copper content 1.779 per cent. Estimating an average mill recovery of 70% of the copper available, gives a total of 14,015,675 tons of recoverable copper. By referring to Table 2, it will be seen that the five large porphyry copper mills in this country at the present time are obtaining from 66.04 to 69.93% recovery. These recoveries are all made on wet concentration. The 7500-ton Inspiration mill is about to begin operation using oil flotation, and it is the expectation to obtain at least 80% extraction. A large leaching plant is being designed for the New Cornelia, which is expected to show a better recovery than is now being obtained by wet concentration, and the same is true, as to expectations, of the Chile Copper leaching plant, which is just now being tuned up. So that, assuming a total average recovery of 70%, although higher than the actual recovery in the five mills operating today, is not an unreasonable or unconservative estimate.

The total mill capacity today, either operating or building, is 74,150 tons daily. At this rate of production, the

stated ore reserves would last about 42 years. Of this milling capacity, the Inspiration, New Cornelia and Chile are not yet producing, and they comprise one-third of the total. This means that when these three new mills are in operation, they will increase our copper production 50% over what it is now. It is true that the Chile Copper is in South America, but it is an American corporation, and its production will be handled through American channels. These figures do not take into account the fact that the Chile expects to duplicate its 10,000-ton plant at an early date. With this total milling capacity of 74,150 tons per day, turning out copper, the total annual production resulting will be 675 million pounds of copper from these sources alone, compared to our total production in 1914, which amounted to 1135 million pounds, of which more than 800 million pounds came from other copper-producers than these mentioned in this table.

Table 2 gives operating figures compiled from the annual reports of the companies named, for the year 1914.

TABLE 2. MILLING RESULTS

	Utah Copper	Ray Con.	Chino Copper	Nevada Con.	Miami Copp r
Tons ore handled in 1914.....	6,470,166	2,429,330	1,907,300	2,640,294	1,096,633
Gross pounds copper produced.....	121,779,401	59,044,700	56,841,977	.....	35,048,445
Net pounds copper produced after smelter and other deductions.....	115,690,445	57,004,281	53,999,928	49,244,056	.....
Ratio of concentration.....	19.33	16.11	12.89	6.05	17.2
Mill recovery, %	66.04	67.88	67.858	68.48	69.93
Milling cost, cts. per ton.....	35.36	49.88	55.01	52.30	49.96
Total net cost, cts. per lb....	7.245	8.763	7.35	8.91	9.20

Owing to the derangement of the copper situation because of the war, these mills did not run at capacity, so that it may properly be expected that these nominal capacity figures will be exceeded for the current year.

The Ohio Copper, which was included in the table published four years ago, is omitted in the present instance because of the fact that the Ohio is tied up in litigation, which, in addition to its unfortunate operating career, makes futile any estimate of when it will again be a factor in copper production*; and its affairs are in such shape that only an unsatisfactory statement of ore reserves and the copper tenor can be obtained. It is probable that the Ohio has something over 10 million tons of ore that will average between 1.0 and 1.5% copper.

The Price of Gasoline

A recent Chicago news dispatch is authority for the statement that the Standard Oil Co. has been caught red-handed in the act of not charging enough for its wares, says the New York *Sun*, which then continues as follows:

In the Western states, where gasoline is a vital factor in so many farm and village operations, pumping, sawing wood and all the other many uses to which the gasoline engine can be put, to say nothing of vast consumption in the thousands of automobiles in use among farmers and even red Indians, the Standard company has been steadily squeezing down the price until this modern elixir of rural life is now selling at 8½c. per gal.

Independent dealers either cannot or will not meet these figures, and they are going to "have the law on" the octopus about it. One independent is quoted as saying that every attorney-general in the Western states will be appealed to. The strong arm of state law is to be invoked to compel the Standard Oil Co. of Indiana to raise its price for gasoline. Failing in that quarter, there is to be a move on Washington. The national Department of Justice is to be put in motion. It is proposed to ascertain definitely, once for all, whether the purchasing public is to be deprived of the privilege of paying more for the gasoline it uses than producers ask for it.

On its face there would seem to be a pretty good chance of the octopus having for once some degree of public sentiment on its side of a controversy. If gasoline were the plutocrat's luxury instead of the poor man's necessity the matter might assume another complexion. Forcing malefactors of great wealth to pay a tax to support possible competitive inefficiency or incompetence in the production of a given article is one thing. Levying for that purpose a tax that hits nearly everybody is quite another. The plain people's sympathy with the tribulations of an octopus competitor is very likely to become purely academic at precisely the point where removal of such tribulations begins to rap the plain people's pocketbook.

The tendency to a callous indifference to their right to pay more than they have to for things has been manifested on every occasion when the question was brought up. It was strongly in evidence when this same gasoline issue was raised against the Standard Oil Co. in New Jersey. Although the octopus triumphed in that case the Jersey masses have gone right on paying their 9 and 10c. per gal., instead of 15, 16, or 18, without so much as a murmur of protest. If the iron heel of the oppressor is on their necks even elementary regard for veracity compels the admission that they seem to like it.

*Since this was written the General Exploration Co. has been incorporated, has assumed a lease of all the Ohio property and promises early resumption of operations.

Production of Mica in 1914

There was a marked decline both in the production and in the importation of mica in the United States in 1914. According to Douglas B. Sterrett, of the U. S. Geological Survey, the value of the mica produced in the United States in 1914 was $328,746, a decrease of $107,314 from 1913. The production came from 13 states. The output of sheet mica amounted to 556,933 lb., valued at $277,330, as compared with 1,700,677 lb., valued at $353,517 in 1913; and the production of scrap mica in 1914 amounted to 3730 short tons valued at $51,416, as compared with 5322 short tons valued at $82,543 in 1913. The output of sheet mica in 1914 fell considerably below the average for the preceding four years, but the production of scrap mica compared more favorably with the average production during these years. There was also a decline in imports of unmanufactured and trimmed sheet mica in the United States, the value for 1914 being $625,396, as compared with $943,018 in 1913. Sheet mica is principally used as insulation in the manufacture of electrical machinery and for glazing in stove doors and gas-lamp chimneys. Ground mica is extensively used in certain wall papers, in tar-roofing paper, and in concrete facing to give a natural-rock finish.

Silver King Consolidated

For the year ended Feb. 1, 1915, the Silver King Consolidated Mining Co. of Utah, Park City, Utah, shows a profit of $76,645 and dividend payments aggregating $251,032 for the year, thereby decreasing quick assets $174,387 during the year. The total receipts for the year were $413,025 and the expenditures $336,380. The ore statement shows that 9987 dry tons of ore were sold, containing 503,784 oz. of silver, 513,763 oz. of gold, 5,593,786 lb. of lead and 257,912 lb. of copper. This ore was sold for $346,990 at the mine, which represents a net price after paying freights, smelting charges, smelting losses and selling charges. The average price received per ton was $37.74. Total dividends to date amount to $559,923. Development work to the amount of 10,127 ft. was performed. According to the report of the consulting engineer, the mine is well equipped and has a good ore reserve developed.

Structure of the Cuyuna Iron-Ore District of Minnesota

By Charles A. Cheney, Jr.*

SYNOPSIS—Working out of the structural geology of the Cuyuna Range connecting it with the Mesabi and Gogebic. Effect of chemical composition and preëxisting topography on location of orebodies. Bearing of quartzite, slate and schist members in various ranges correlated and the presence of greenalite in Mesabi and its absence in Cuyuna discussed.

Since the discovery of the Cuyuna iron-ore district in 1903 it has been considered as a connecting link between the Mesabi district of Minnesota and the Penokee-Gogebic district of Michigan and Wisconsin. The exact structural relations of the Cuyuna district to the other two districts, have not, however, been determined. This has been due to the lack of rock outcrops and to the fact that development work has not yet been extensive enough in the Cuyuna district from a geological standpoint.

In view of the fact that many years may elapse before the structure of the Cuyuna district becomes known with any degree of certainty, the writer has endeavored to indicate on the accompanying map one plausible solution of the structure and the possible relations of that district to the Mesabi district. Iron-bearing formation may be absent in a large part of the area where its trace is indicated on the map as a guide to the structure, but its absence may be explained by the fact that it may have "lensed out" or that it may have been obliterated by the differential movement between the beds above and below.

The magnetic lines in northern Cass County have been considered by many as indicative of the presence there of the Biwabik formation of the Mesabi district thrown to the north by faulting or folding, but the results of private work to the north and east seem to indicate clearly that these magnetic lines are caused by a formation of Keewatin age. Furthermore, the sharp southward trend of the Biwabik formation of the western Mesabi district is indicative of a connection of this formation with the iron-bearing formation of the Cuyuna district.

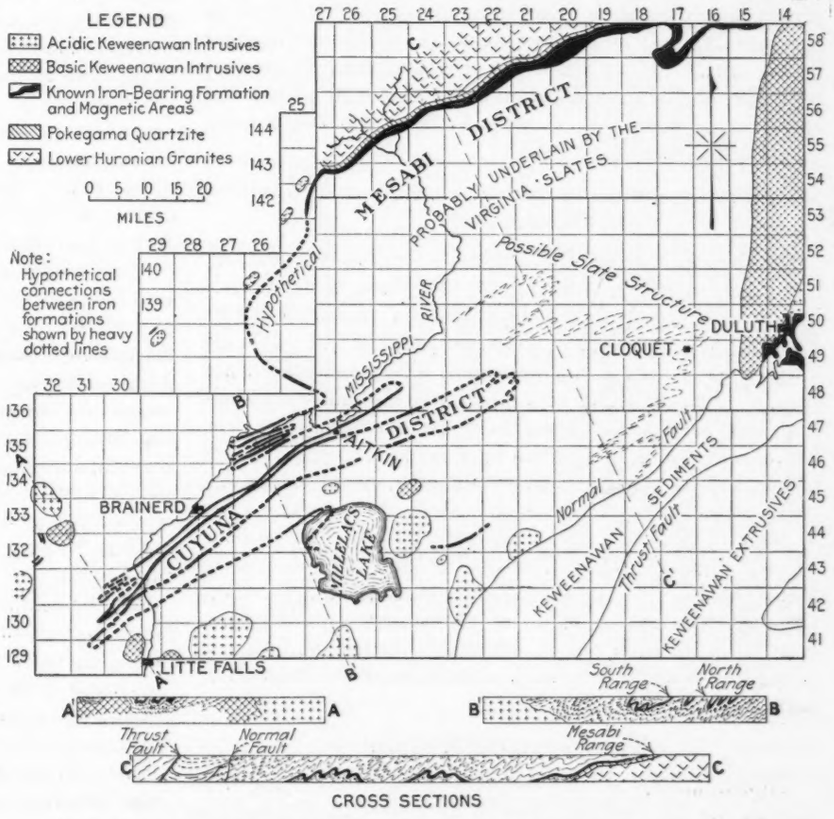
Therefore it seems logical to assume that the iron formation reported in township 138 range 26, township 137 range 26, and the iron-bearing formation in township 137 range 25 are portions of the fold connecting the north range of the Cuyuna and the western Mesabi.

*Geologist, Madison, Wis.

Folding of the Cuyuna District

The folding of the Cuyuna district is the result of both the general Keweenawan folding of the whole Lake Superior region and more locally the intrusion of Keweenawan igneous rocks to the south of the district. Since the main axis of the Lake Superior syncline is southeast of the district and since the main intrusive mass is to the south, it follows that by far the greater thrust which caused the deformation of the district was from the southeast. This has resulted in the formation of a series of roughly parallel folds with axes striking about N55E. The folding on the south range of the Cuyuna differs from the north range folding, however, for reasons which will appear.

The present location of the Biwabik formation of the Mesabi district is probably due to the fact that the large mass of Lower Huronian granites constituting the Giant's Range was not covered by the Upper Huronian sea, and formed to the south a shore line. It is plausible therefore to assume that the location of a gently curving formation extending from the western Mesabi to township 137 range 25 may be due to the presence in this region of Lower Huronian granites below and to the west. The presence of Lower Huronian granites in township 141 range 25 and in township 140 range 26 is therefore significant.



Map Showing Probable Structure of Cuyuna District and Relation to the Mesabi District

Furthermore, the protecting presence of such a mass or core must have been necessary to save this portion of the Upper Huronian from the general close northeast and southwest folding of the rocks of the Cuyuna district proper.

Against this granite mass the formations of the north range of the Cuyuna district were crumpled in a series of close-repeated folds pitching toward the northeast.

On the other hand, the formations of the south range were subjected to a largely dominant thrust from the southeast without the tension to the northeast, which acted as a drag in the north range folding. Moreover, the rocks of the south range were relatively much freer from compression from the northwest. For this reason the folds of the south range formation are more open and gentle and of very low pitch. It follows that pitching-drag folds are relatively unimportant in the iron-bearing formation of the south range.

On the north range, drag folding has probably been the principal factor in determining the locations of the orebodies. This is evidenced by the relatively great depth of concentration of some orebodies; by the fact that linear dimensions are not so great in proportion to width as on the south range; by the brecciated character of the ores; by the areal distribution of the orebodies; and by the fact that the orebodies are often concentrations within the iron-bearing formation, namely, bounded by iron-bearing formation rather than slate.

Effect of Chemical Composition and Ancient Topography

On the south range the original chemical composition, the degree of metamorphism and the effects of a preëxisting topography have probably been the principal factors governing the locations of the orebodies, and not pitching-drag folds. There is much evidence to support the former theory. The orebodies are apparently all relatively shallow; they all possess distinctly linear characteristics; the formation is not brecciated to a large degree; the orebodies are in general clearly defined concentrations between slate walls; and the barren areas are generally areas of amphibole-magnetite rock rather than ferruginous cherts. Broken and relatively offset magnetic lines have been considered as indicating the locations of drag folds, although the best orebodies of the south range have not been found in such places, but rather where the presence of the iron-bearing formation is indicated by a continuous, unbroken magnetic line.

The Quartzite Member

Objection may be made to placing the iron-bearing formation of the Cuyuna district at the same horizon as the Biwabik formation on the ground that an underlying quartzite formation has not been traced in the Cuyuna district. As a matter of fact, quartzite has been penetrated by drills at several places on the north range along the outlines of the folds as shown. Furthermore, exploration work has been localized along magnetic lines, and this has tended to prevent the discovery of a quartzite member, if it were present throughout the district.

If the quartzite is present in the district, the slates underlying the iron formation may be considered as having been deposited during the time the lower portion of the Biwabik formation of the Mesabi was being deposited. Furthermore it is unnecessary to assume an erosion interval such as is represented by the thin conglomerate at the base of the Biwabik formation of the Mesabi. It is extremely unlikely that conditions of deposition should have been the same contemporaneously over such a large area. In this connection it may also be noted that the Biwabik formation is characteristically interstratified with slates at certain horizons, and that these slates are chemically and texturally similar to the Virginia slates.

Slates and Schists

If the quartzite member is absent in the Cuyuna district, the slates underlying the iron-bearing formation may be considered as the equivalents of the Pokegama quartzite. It is not unreasonable to assume that the quartzite of the Mesabi district may grade into slates along the strike.

Furthermore, the absence of slates and schists of Lower Huronian age in the Cuyuna district has not been proved. The Morrison County schists in the vicinity of Little Falls have been correlated with the Upper Huronian slates of the Cloquet-Carlton area largely because of the presence of carbonate nodules in both and because of an apparent geographic continuity. The latter factor can be as well explained, perhaps better, by considering the Morrison County schists as of Lower Huronian age. The fact that these schists are metamorphosed to such an extent that their sedimentary characteristics are practically obliterated is further evidence that they may be of Lower Huronian age. Spurr so correlated these schists.

In view of these facts it may be that the cores of anticlines in the Cuyuna district are largely composed of Lower Huronian slates and schists.

It may be argued that the Cuyuna iron-bearing formation is not an extension of the Biwabik formation, but lies at a higher horizon, namely, that the Cuyuna iron-bearing formation consists of lenses of iron formation within the Virginia slates. If this is the case it is remarkable that traces of a formation which might then be correlated with the Biwabik formation have not been found outlying the Cuyuna formation, and also that to the south of the Biwabik formation of the Mesabi range and hence at higher horizon, no evidences have been found of the existence of an iron-bearing formation which might be correlated with the Cuyuna.

In this connection the log of a deep diamond-drill hole sunk in section 30, T58N—R15W may be of interest. This hole* was located approximately four miles south of the south edge of the Biwabik formation and therefore penetrated a great thickness of the Virginia slates. The formations passed through were as follows: Glacial drift, 183 ft.; black slate (the Virginia slate), 1974 ft.; taconite (the iron-bearing formation), 569 ft.; quartzite, 19 ft.

Presence of Greenalite

It is noticeable that in the entire distance sunk in the slate no lenses of iron-bearing formation were encountered, or if so, no mention is made of the fact. The fact that no evidence of the existence of greenalite has been found in the rocks of the Cuyuna iron-bearing formation has also been cited as indicating that this formation is, stratigraphically, distinct from the Biwabik formation.

In Monograph LII of the U. S. Geological Survey, "The Geology of the Lake Superior Region," p. 516, the following statement is made: "In general the parts of the

*"Deep Diamond-Drill Hole with Light Equipment." By P. W. Donovan, "Eng. & Min. Journ.," Mar. 28, 1914.

iron-bearing formations originally consisting of carbonate seem to be related to the indirect contribution from the igneous rocks through the agencies of weathering, and the parts of the iron-bearing formations originally consisting of greenalite, or iron silicate, seem to have been contributed in the main directly to the waters without intervening atmospheric or organic agencies. The locally close association of these two types of the original iron-bearing rocks indicates the close association of direct and indirect methods of contribution of iron-bearing materials."

Whether, in a given case, greenalite or iron carbonate would be precipitated may also be dependent on the relative amounts of carbon dioxide present. An abundance of carbon dioxide would result in the ultimate precipitation of the carbonate. Therefore the fact of the presence of greenalite in the Biwabik formation of the Mesabi district and its apparent absence in the Cuyuna iron-bearing formation may merely indicate a difference in conditions of contemporaneous deposition of the same formation.

Centrifugal Mine Pumps on the Rand*

On account of the high cost of pumping at the Durban Roodepoort Deep, where it was necessary to handle 10,000,000 gal. of water per month against a total head of 2490 ft., Sulzer centrifugal pumps were installed with interesting and gratifying results.

Operations are through a five-compartment compound shaft, the depth of the vertical part being 1586 ft. and the length of the incline part being 1174 ft. The water column is of Mannesman solid-drawn pipe 8 in. diameter throughout, with wood lining 1 in. thick, thus making the effective diameter 6 in. The thickness of the piping is 7 mm. in the lower half of the shaft and 6 mm. in the upper half, where the pressure is less. The guaranteed factor of safety on the material of the piping is not less than 3.75. Piping was in standard lengths of 21 ft., and the pipe-joints used were the double-border type shown in Fig. 1.

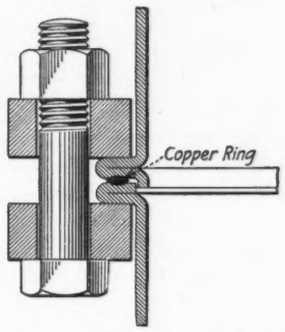


FIG. 1. DETAIL OF JOINT IN WATER COLUMN

At every 500 ft. in the shaft the piping was carried on two channel-bearers hitched into the foot and hanging wall. Cast-steel pipe supports, shown in Fig. 2, were inserted in the pipe-line and bolted to the channels, thus insuring that the weight of the pipe was not carried in any way by the timbering of the shaft. Between these main supports, light steel joists every 90 ft. were hitched into the shaft, and the pipe clamped to them with wrought-iron straps.

OBJECTIONS TO CENTRIFUGAL PUMPS

One of the principal objections to the use of centrifugal pumps on the part of the company had been the difficulty previously experienced in handling gritty and dirty water. In order to provide clear water for these pumps, a system of sumps was provided so that the water ran first into a settling sump, then overflowed through an overflow launder into the main sump and overflowed this again into a suction sump, from which the pump took its supply.

In addition to the water column being wood-lined to make it acid-resisting, the water is neutralized with carbonate of soda at a cost of approximately 5.2c. per 1000 gal. pumped. A log book is used in the pump station in which hourly records are kept of the clarity of the water and of the percentage acidity. The result of this systematic attention has been that the water which the pumps are handling is practically free from solids and free from acid. The sludge which is cleaned from the settling sump periodically is dewatered by being put through a filter press, after which it is a clean product for handling and goes to the regular underground and surface bins and chutes.

PUMPING AND MAINTENANCE COSTS

The net cost of pumping for a period of 12 months is at the rate of 64.6c. per 1000 gal.; the pumping cost with the old plant was $1.012 per 1000 gal. These figures do not show the actual cost of centrifugal pumping, because in the first case there were some of the old pumps used in connection with the new centrifugal units, but they show the saving by using the two centrifugal units. The pumping costs are interesting further, as it is not common to find costs per gallon given. A complete record of costs of maintenance and repairs was kept for a period of 12 months, during which time 111,650,000 gal. of water was pumped. The total cost for this period amounts to only 0.77c. per 1000 gal. Sixty days after the pumping plant was put in operation a test was made to ascertain if the efficiency was equal to that guaranteed by the manufacturers. A year later another test was made to determine how much the efficiency had fallen off during the period. The two pumping units gave such close results that the figures given in the table are the average for the two pumping units:

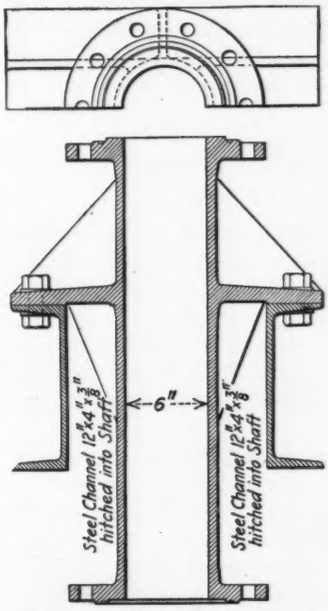


FIG. 2. STEEL SUPPORTING SECTION IN WATER COLUMN

RESULTS OF TWO PUMP TESTS

	Guaranteed Figures	First Tests	Second Tests
Head in feet	2490	2520	2549
Gallons per minute	375	449	406.5
Input hp. into motors (integrating watt-meter readings ÷ time)	....	573	538.5
Hp. input into pumps, based on 92% motor efficiency	....	527	495
Average efficiency of pump	62%	65%	63.4%
Overall efficiency of pump and motor	57%	59.8%	58.3%

Of course, the principal point in the table is the over-all efficiency of the pumping unit, which was 59.8% when installed and which was 2.8% greater than the

*Abstract of paper by E. G. Izod (member) and A. P. Rouillard, in the "Journal" of the South African Institution of Engineers, January, 1915.

guarantee. After a year's operation, the efficiency of the unit was 58.3%, showing a loss during the year of 1.5%, but still showing an over-all efficiency of 1.3% more than the original guarantee. This speaks well for both the efficiency of the operation and the excellence of the construction, allowing of course due credit for the care given by the mine management to provide water which is free from grit, dirt and acid.

Cost of Pumping 1000 Gal.

Careful records were kept of actual metered units into the pump and the water quantities delivered at the collar of the shaft during a period of seven months; these records show that the cost of power was 0.642c. per 1000 gal. per 100-ft. lift. An independent test to determine this same factor checked these results, and they are also confirmed by results obtained at the Crown mine using similar pumps.

At the Knights Deep, using reciprocating pumps and pumping 14,000,000 gal. per month against a head of 2150 ft., under conditions similar to the duty required of the centrifugal pumps described, the net cost of pumping was 0.578c. per 1000 gal. per 100-ft. lift. This shows a saving in power cost of 10.8% in favor of the reciprocating pump, but the mine management contends that the saving in maintenance of the centrifugal pumps fully compensates for this increased cost of power.

Reasons for Choosing Centrifugals

The particular reasons which induced this mine to install centrifugal pumps were as follows:

1. Initial Cost.—The complete cost of the centrifugal pumping plant, including motor, starter, bed-plate, etc., delivered, was approximately 60% of the cost of a reciprocating plant with a similar capacity, 800 gal. per min. against 2500-ft. head. For a 2000-gal. per min. plant against 2250-ft. head, the centrifugal pumping equipment would have cost only 40% of the reciprocating equipment.

2. Weight of Plant.—The centrifugal equipment weighs approximately 70 lb. per gal. of water pumped per min. A reciprocating equipment would have weighed approximately 350 lb. per gal. per min.

3. Reliability.—This was an unknown figure when the pumps were installed, but it was the opinion of the engineers that the figures would be in favor of the centrifugal, and the results of the year's run have confirmed this opinion, as there has been no trouble of any sort experienced with the pump.

4. Cost of Maintenance.—This also was an unknown figure, but the maintenance costs for the period of operation have proved a big item in favor of using centrifugal pumps and have justified the judgment in their installation.

5. Cost of Excavations for Pump Chamber.—The larger the quantity of water to be handled, the bigger is the proportional saving by using centrifugal pumps. The excavation of rock for the pumping equipment in this particular instance was 8000 cu.ft., while a reciprocating equipment of similar capacity would have required 55,000 cu.ft. of excavation. For a 2000-gal. per min. plant the excavation for a centrifugal equipment would be approximately only 10% of the cost of excavation for a reciprocating equipment. The following interesting table shows these figures as compiled and calculated from several makers' drawings for the reciprocating pumps, from which were selected those pumps which occupy the smallest space for their capacity.

COMPARATIVE SIZES AND COSTS OF PUMP CHAMBERS

Capacity of Plant, Gal. per Min.	Centrifugal Pumps: Cubic Feet of Excavations	Centrifugal Pumps: Total Cost of Chamber at 12c. per Cu.Ft.	Reciprocating Pumps: Cubic Feet of Excavations	Reciprocating Pumps: Total Cost of Chamber at 12c. per Cu.Ft.
800	8,000	$1,000	55,000	$6,875
2,000	13,000	1,625	130,000	16,000

Other Advantageous Features

In addition to what has already been said, the results of a year's experience with this particular plant have impressed upon the management the merit of centrifugal pumps for high lift, in the simplicity of repairs and replacement, smoothness of running and minimum of attention required during operation.

Anaconda Enters Chile

There has been much speculation for a long time past among mining men as to the identity of the interests controlling the Andes Exploration Co., which for a good many months has been carrying on not only exploration work, but also actual developments on properties situated in Chile, under the direction of William Braden and a staff of engineers. Mr. Braden, who is a well-known mining and metallurgical engineer, was the discoverer and developer of the property now owned by the Braden Copper Co.

It is stated upon reliable authority that the Andes Exploration Co. is controlled by the Anaconda Copper Mining Co. This report is of more than passing interest, inasmuch as it will be the first time that the Anaconda Co. has actively engaged in mining operations outside the United States. If it succeeds in developing suitable properties, this should mean much to South America, for the Anaconda company is especially well equipped to bring to a successful outcome any undertaking, no matter how great. It is stated that the investigations which are being conducted by the Andes Exploration Co. are not confined to copper mines alone, but that its engineers are also very active in the tin fields of Bolivia, not looking toward the purchase of developed tin mines, but rather toward the development of promising prospects on its own account.

We understand that a copper deposit near Portrerillos that is being extensively drilled gives promise of becoming a large mine that will be profitably worked. Portrerillos is about 50 miles southeast from Pueblo Hondido in northern Chile. A railway connects Pueblo Hondido with the port of Chañaral.

Portugal Prohibits Tin Exports

A decree has been issued prohibiting the exportation and reëxportation of tin from Portugal to foreign countries, according to the *Iron and Coal Trades Review*. The decree also prohibits the transit and transshipment of the metal (when intended for foreign countries) if the consignments are described in the manifests or bills of lading as being "to order," or if there is no clear indication entered on the documents at the place of shipment as to the name of the consignee and the destination of the goods.

Asbestos Production of the United States in 1914 was 1247 tons, an increase of 13% over 1913.

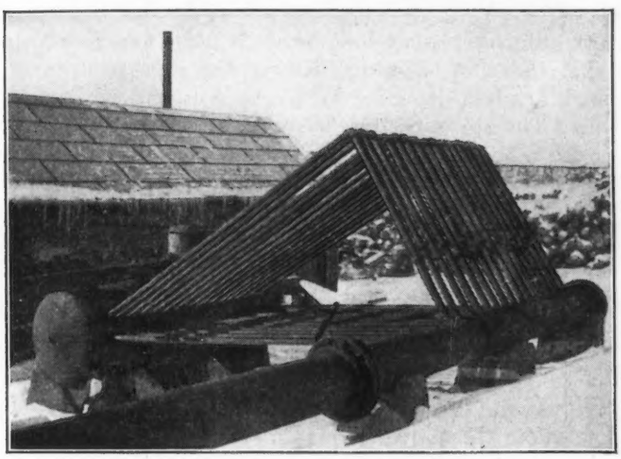
Details of Practical Mining

Novel After-Cooler for the Compressor Plant

By F. H. Armstrong*

Because of the trouble from rock drills freezing underground, it was decided to install an after-cooler ahead of the air receiver of the compressor plant. As it was a nuisance to pipe water to the cooler and maintain it in winter weather, an air-cooled after-cooler was thought advisable.

The discharge from two 3100-ft. compressors for about 300 ft. was made from some old Cornish-pump columns 17 in. in diameter. The end of this line was blanked, and



After-Cooler for Compressor Plant

thirty 3-in. pipes connected from it to the receiver, as shown in the accompanying illustration.

The cooling is perfect when only one compressor is running, but not quite so good as is desired when both compressors are in use. During a snowstorm, when only one machine is running, there is snow on the discharge pipes leading from the receiver to the mine, while the 17-in. line is steaming.

How to Prolong the Life of Steam-Shovel Hoisting Chains

A very severe and apparently unavoidable wear on the outside of links on steam-shovel chains takes place when the second wrap of chain starts winding on the drum. The chain climbs on the under wrap and in slipping down to a bearing causes a tearing action, which wears the chain on the outside of the links, while the ends show but little wear. If the following simple method is adopted it will greatly relieve this condition:

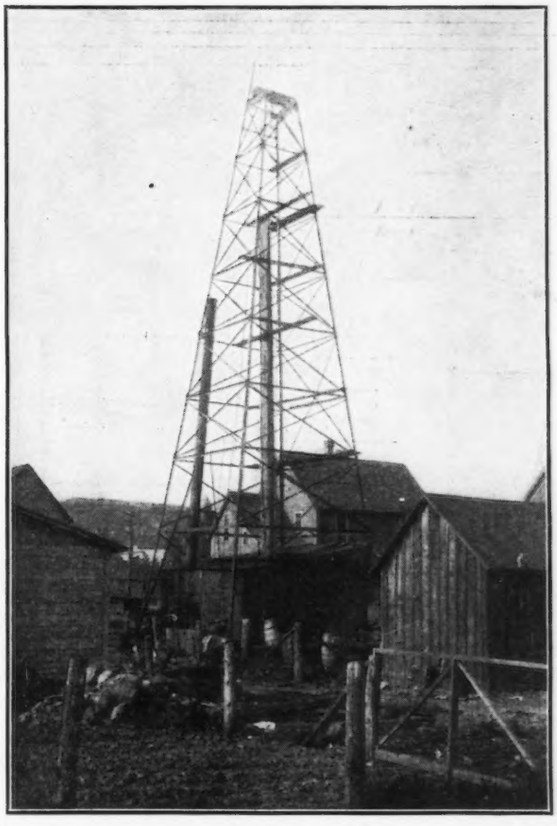
Attach with a "missing link" a piece of old chain long enough to make 1½ wraps around the drum. After the chain has been in use a sufficient time to show considerable wear on the outside of the links where the second wrap begins, remove the old piece of chain and attach the end of hoisting chain to the drum. This will place the wearing faces on new sections, which are full size, and double the life of the links at this point.

This method is suggested by the Columbus Chain Co., according to the *Excavating Engineer,* but holds good, of course, for any make of chain.

*Mechanical engineer, Vulcan, Mich.

A Steel Diamond-Drill Derrick

The accompanying illustration shows a steel derrick over a diamond drill, belonging to the Cleveland-Cliffs Iron Co., at work in the heart of the City of Negaunee on the Marquette range, Michigan. The frame is 60 ft. in height and permits the use of 50-ft. drill rods; while the wooden tripods, which are generally in use, can handle



A Steel Diamond-Drill Derrick

only 30-ft. rods. It is built entirely of light steel angle-iron and is so constructed that it can be easily moved. It is the only steel derrick of its kind in the Lake Superior district and was constructed by the Sullivan Machinery Co., of Chicago. The hole is now almost 3000 ft. deep. A hole put down in the same vicinity a few years ago disclosed a considerable depth of ore.

Efficiency of Air Compressors and the Measurement of Air Flow*

Some foreign compressor builders have been converted from the common practice of stating the output of their compressors on calculation based on piston displacement and indicator-card diagrams to the more accurate method based on actually measuring the output by direct means. This ought to be adopted by all air-compressor manufacturers. The difference shown by the two methods, as the result of tests in one instance, was that the measured efficiencies were about 10% below those guaranteed by the manufacturers, which were based on calculation. The guarantee for large compressors was 68.8% at full load, while the figure on actual test was only 58.8%. The larger part of the difference was stated to be due to the method of estimating the output of the air by calculation as against direct measurement. The volume of free air at atmospheric pressure delivered by reciprocating compressors is generally not more than 88.5% of the piston displacement, and is often less. Calculations from indicator cards generally show 92 to 95%.

By inserting a sharp-edged orifice-plate in a straight length of the delivery pipe, and by making the diameter of the orifice about three-quarters of the diameter of the pipe, the pipe diameter being chosen so that the difference in pressure across the orifice is equivalent to about 24 in. of water, very reliable results are obtained by the following formula:

$$W = 0.735\, a \left(\sqrt{\frac{2g}{R}}\right)\left(\sqrt{\frac{Ph}{T}}\right), \text{ where}$$

W = pounds of air flowing per second.

a = area of orifice in sq.in.

g = acceleration due to gravity (ft. per sec. 32.11).

R = gas constant for air. This is calculated according to the relative effects of the constant for dry air and the constant for steam gas in the proportion which the weight per cu.ft. of dry air bears to the weight per cu.ft. of aqueous vapor in the air entering the compressor. The constant for dry air is taken as 53.22, and the constant for steam gas as 85.6.

P = pressure on the downstream side of the orifice in lb. per sq.in., absolute.

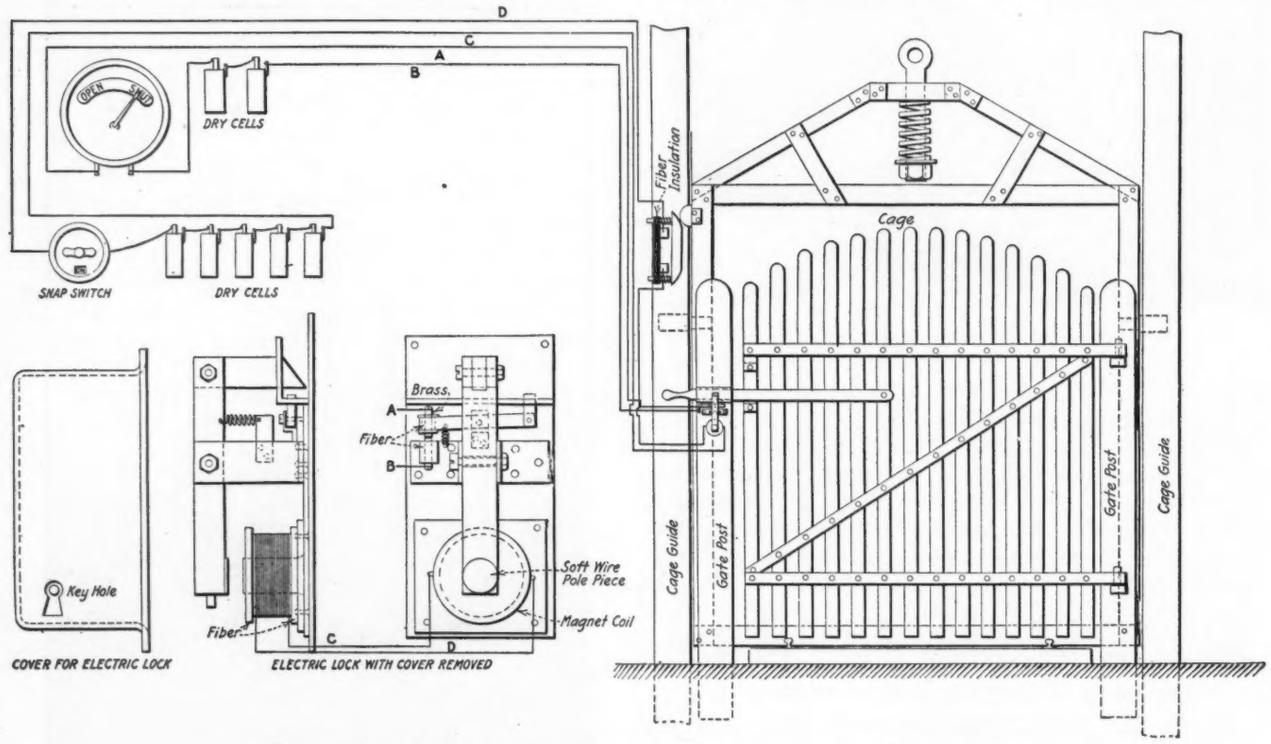
h = difference of pressure between the two sides of the orifice in lb. per sq.in. (as shown by manometer).

T = absolute temperature of the air on the upstream side of the orifice = 460.7 + deg. F.

*Extracted from a paper presented by J. H. Rider before the Institution of Electrical Engineers, London.

Automatic Safety Lock and Indicator for Shaft Gates

An automatic safety lock for shaft gates, together with a dial indicator showing whether the gate is open or closed, has been invented by W. A. Williams, of Barton, Ohio. The object of this device is automatically to lock and unlock the gates of elevator shafts, particularly those on the hoisting shafts of coal mines, during the time that men are being hoisted or lowered, says *Coal Age*.



ELECTRICAL CONNECTIONS FOR SHAFT-GATE LOCK AND INDICATOR

The accompanying drawing shows a cage at the shaft landing and a gate hinged to a post. On the gate a bar is pivoted which extends through a keeper and is movable vertically at one end. On the face of the adjacent gatepost is a plate with a suitable catch for holding the locking bar.

An electromagnet is introduced into the locking mechanism in such a way that when it is energized a bolt is

withdrawn from the lock, allowing the locking bar to be swung out of contact with its catch, thus permitting the gate to be opened.

The coils of this electromagnet are included in and form a part of an open electric circuit, one side of which leads from a source of electric energy, while in the other is a bridge-piece or switch. When the cage is approaching the position at the landing, a contact mounted upon it closes the circuit, thus energizing the magnet, withdrawing the bolt in the lock and allowing the locking bar to be elevated. If the cage is but slightly moved, however, the contact is broken and the locking bar cannot be moved.

A snap switch is also introduced into the circuit whereby the latter may be broken, rendering the latch bolt inoperative, so that the gate is held in a closed and locked position. This snap switch may be located at any convenient point, usually in the engine room.

The electric lock is provided with a cover and so arranged that the introduction of a suitable key will open the lock independently of the electric circuit. This key of course permits of the gate being opened when the cage is not at the landing. It should be carried by some person in authority, so that the gate may not be opened and left open by some irresponsible individual.

In the engine room a dial indicator is placed which shows at all times the movement of the latch bar through suitable electrical connections. When the latch bar is disengaged from the locking mechanism, the dial stands at the open position, while when the gate is closed and the latch bar dropped into its place, the dial stands at shut.

Shaft Timbering and Headgear on the Mesabi Range

Typical shaft-sinking practice on the Mesabi range is shown in the accompanying illustrations.[1] In this particular instance it was necessary to build up the collar of the shaft in order to get dump room; and as the ground was soft, top bearers were used, and to increase their strength they were trussed as shown in Fig. 1. Using the temporary headframe shown in Fig. 2, the shaft was sunk at a total cost of $42.49 per ft., the labor amounting to $27.70 and supplies to $14.79 per ft. The temporary headframe, which it was necessary to guy, was subsequently replaced by a standard type A frame (Fig. 3), which in use has proved perfectly rigid and satisfactory. The hoist is 150 ft. back from the shaft.

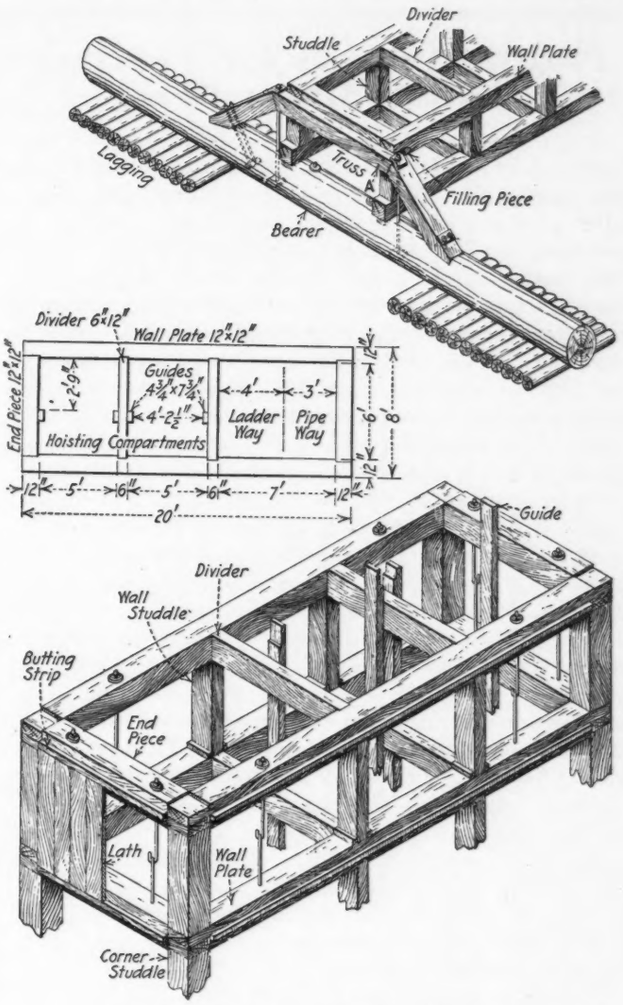


FIG. 1. SHAFT TIMBERING DETAILS

[1]From the "Wisconsin Engineer," April, 1915.

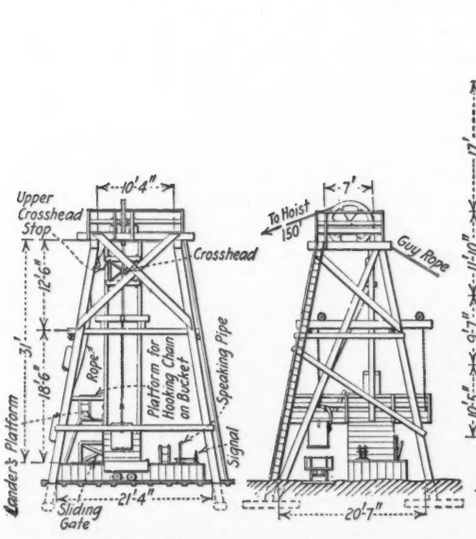


FIG. 2. TEMPORARY HEADFRAME

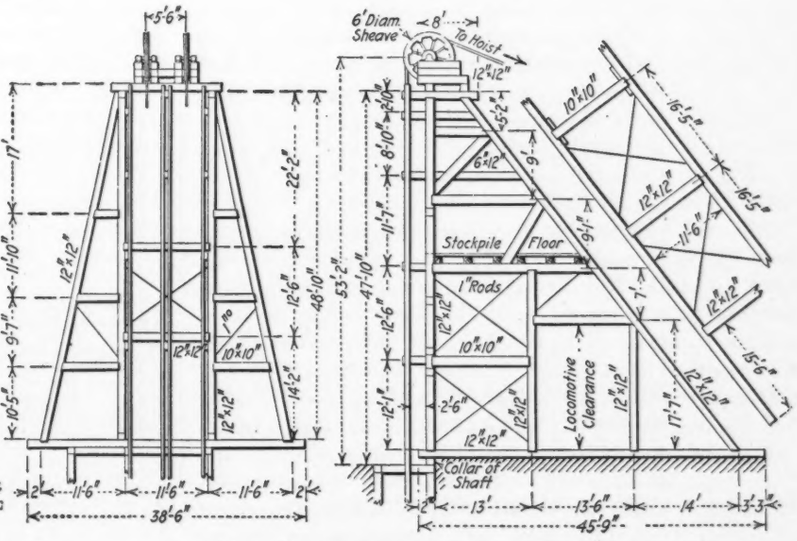


FIG. 3. PERMANENT HEADFRAME

Details of Milling and Smelting

Phillips Process for Treating Cobalt-Silver Ores

A new process for treating cobalt-silver ores has been suggested by William Phillips, of Swansea, Wales (U. S. pat. 1,127,506). According to this process the cobalt-silver ores are smelted in the raw state in a blast or reverberatory furnace, together with a mixture of raw iron matte and the copper residue which remains after the extraction of silver by the well-known Ziervogel process, when speiss, argentiferous copper matte and slags are produced. About 82% of the silver in the ore passes into the copper matte, and about 17% passes into the speiss and about 16% of the copper in the matte passes into the speiss. The argentiferous copper matte containing sulphides of copper and iron will contain between 2000 and 3000 oz. of silver per ton, and the matte, 25% of copper.

The silver and copper in the speiss is extracted by smelting it in a reverberatory furnace together with raw iron matte, when about 60% of the silver and copper into the speiss passes into the iron matte on the first melting. The melting is repeated with fresh portions of iron matte three or more times until the speiss is practically free of silver and copper and in a condition suitable for treatment for the separation of the nickel and cobalt contained in the original ore. The iron matte, which now contains the silver and copper that were in the speiss, is utilized in the raw state in the smelting of the silver ores and copper residue, using the necessary proportion to reduce the copper oxide in the residue to a sulphide and producing the same weight and percentage of copper in the matte formed that the residue contained, thus enabling the same copper to be used indefinitely for the collection of the silver.

The oxide of iron in the residue combines with the silica in the ore, producing the required slag. The silver in the argentiferous copper matte is extracted by the Ziervogel process. The matte is crushed to a fineness such that it will pass through about a 16-mesh screen, then calcined and the calcined matte again crushed, this time to about 40 mesh, and further calcined. Calcining is continued until the silver is converted into the sulphate. It is then leached with hot water, which dissolves the silver sulphate, the solution being passed over copper plates, where the silver is deposited.

After the depositing of silver the solution passes through a tank containing scrap iron, precipitating the copper. Copper and silver are cleaned up and refined according to well-known methods. The copper residue, consisting principally of copper oxide from the argentiferous copper matte after washing out the silver, is smelted with the cobalt-silver ore and raw iron matte, when the copper oxide is converted into raw matte again.

The argentiferous copper matte formed on smelting the silver ore mixture contains from 4% to 6% of nickel and cobalt. The iron matte, after removing the silver and copper from the speiss, will contain about 2% of nickel and cobalt, all of which again combines with some form of the excess arsenic in the ore and forms speiss, being thus recovered without additional cost. The arsenic, so objectionable in most processes, is said to be an advantage in this process, since it retains nearly all of the nickel and cobalt without interfering with the separation and recovery of the silver and copper.

Etching Reagents Suitable for Particular Metals and Alloys

The following list from O. F. Hudson's paper before the Iron & Steel Institute, March, 1915, gives the principal reagents which have been found especially suitable for different metals and alloys:

Copper.—Ammonia (sp.gr. 0.88, diluted 1:1 with water), ammonium persulphate (10% aqueous solution), bromine (followed by a wash with ammonia), copper-ammonium chloride (5 grams of copper-ammonium chloride in 100 c.c. of water, add ammonia until precipitate just dissolves).

Brasses.—Ammonia, ammonium persulphate, copper-ammonium chloride, electrolytic etching, ferric chloride (slightly acidulated with HCl), chromic acid (saturated or nearly saturated solution), nitric acid (strong acid, followed by water), Tinoféef's reagent (94 grams HNO_3 and 6 gm. Cr_2O_3, a few drops are used in 50 c.c. of water).

Bronzes.—Ammonia, ammonium persulphate, ferric chloride.

Copper-Aluminum Alloys (Aluminum Bronzes).—Ammonium persulphate, ferric chloride, copper-ammonium chloride, nitric acid.

German Silver.—Ammonium persulphate, ferric chloride.

Nickel-Copper Alloys, Monel Metal.—Electrolytic etching.

Gold and Rich Gold Alloys, Platinum and Its Alloys.—*Aqua regia* (dilute, 1 part HNO_3, 5 parts HCl, 6 parts distilled water, used at 15° C.)

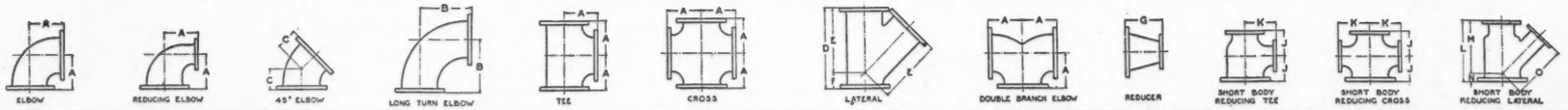
Aluminum and Light Aluminum Alloys.—Caustic soda, hydrochloric acid, hydrofluoric acid (1 part fuming HF to 10 or 20 parts of water, clear after treatment by a few seconds' immersion in HNO_3).

Lead, Tin and Their Alloys (White Metal, etc.).—Chromic acid in nitric acid, ferric chloride, hydrochloric acid, nitric acid, silver nitrate (5% solution).

Zinc and Alloys Rich in Zinc.—Caustic soda, iodine (1 part iodine, 3 parts KI and 10 parts water).

The Oxygen Efficiency in Pyritic-Smelting Furnaces at Mt. Lyell, Tasmania, was announced some years ago as practically 100%. As this was higher than at other plants doing similar work, it was suggested by various metallurgists that oxygen in the furnace gases might have been taken up by the iron pipe used in collecting the samples. At the meeting of the New York Section of the American Institute of Mining Engineers, in New York, Robert Sticht stated that further tests had been made with apparatus that removed all possibility of oxygen being absorbed, and that the results were the same, practically no free oxygen going out of the furnace—at any rate, nothing like 2 or 3%, as had been suggested by various people. At the same meeting George A. Guess stated that an oxygen efficiency of about 87.5% had been attained at the furnaces of the Granby company at Anyox, B. C., in a test extending over a period of about six days. The oxygen efficiency of the Tennessee Copper Co.'s furnaces has been repeatedly calculated at from 70 to 72%.

THE 1915 U. S. STANDARD SCHEDULE OF FLANGED FITTINGS AND FLANGES



STANDARD WEIGHT 125 LBS. WORKING PRESSURE

SIZE	A	B	C	D	E	F	G	Short Body Red Tees & Crosses: Size of Outlets	J	K	Short Body Red. Laterals: Size of Branches	L	M	N	O	Flanges: Diameter	Thickness	Bolts: Diameter of Bolt Circle	Number of Bolts	Diameter of Bolts	Minimum Metal Thickness
1	3½	5	1¾	7½	5¾	1¾										4	7/16	3	4	7/16	7/16
1¼	3¾	5½	2	8	6¼	1¾										4½	½	3⅜	4	7/16	7/16
1½	4	6	2¼	9	7	2										5	9/16	3⅞	4	½	7/16
2	4½	6½	2½	10½	8	2½										6	5/8	4¾	4	5/8	7/16
2½	5	7	3	12	9½	2½										7	11/16	5½	4	5/8	7/16
3	5½	7½	3	13	10	3	6									7½	¾	6	4	5/8	7/16
3½	6	8½	3½	14½	11½	3	6½									8½	13/16	7	4	5/8	7/16
4	6½	9	4	15	12	3	7									9	15/16	7½	8	5/8	½
4½	7	9½	4	15½	12½	3	7½									9¼	15/16	7⅞	8	¾	½
5	7½	10¼	4½	17	13½	3½	8									10	15/16	8½	8	¾	½
6	8	11½	5	18	14½	3½	9									11	1	9½	8	¾	9/16
7	8½	12¾	5½	20½	16½	4	10									12½	1 1/16	10¾	8	¾	5/8
8	9	14	5½	22	17½	4½	11									13½	1⅛	11¾	8	¾	5/8
9	10	15¼	6	24	19½	4½	11½									15	1⅛	13¼	12	¾	11/16
10	11	16½	6½	25½	20½	5	12									16	1 3/16	14¼	12	⅞	¾
12	12	19	7½	30	24½	5½	14									19	1¼	17	12	⅞	13/16
14	14	21½	7½	33	27	6	16									21	1⅜	18¾	12	1	⅞
15	14½	22¾	8	34½	28½	6	17									22½	1⅜	20	16	1	⅞
16	15	24	8	36½	30	6½	18									23½	1 7/16	21¼	16	1	1
18	16½	26½	8½	39	32	7	19	12 inches	13	15½	9 inches	26	25	1	27½	25	1 9/16	22¾	16	1 1/8	1 1/16
20	18	29	9½	43	35	8	20	14"	14	17	10"	28	27	1	29½	27½	1 11/16	25	20	1 1/8	1 1/16
22	20	31½	10	46	37½	8½	22	15"	14	18	10"	29	28½	½	31½	29½	1 13/16	27¼	20	1 1/4	1 3/16
24	22	34	11	49½	40½	9	24	16"	15	19	12"	32	31½	½	34½	32	1⅞	29½	20	1 1/4	1 1/4
26	23	36½	13	53	44	9	26	18"	16	20	12"	35	35	0	38	34¼	2	31¾	24	1 1/4	1 5/16
28	24	39	14	56	46½	9½	28	18"	16	21	14"	37	37	0	40	36½	2 1/16	34	28	1 1/4	1 3/8
30	25	41½	15	59	49	10	30	20"	18	23	15"	39	39	0	42	38¾	2⅛	36	28	1 3/8	1 7/16
32	26	44	16				32	20"	18	24						41¾	2⅛	38½	28	1 1/2	1 1/2
34	27	46½	17				34	22"	19	25						43¾	2 5/16	40½	32	1 1/2	1 9/16
36	28	49	18				36	24"	20	26						46	2⅜	42¾	32	1 1/2	1 5/8
38	29	51½	19				38	24"	20	28						48¾	2⅜	45½	32	1 5/8	1 11/16
40	30	54	20				40	26"	22	29						50¾	2½	47½	36	1 5/8	1¾
42	31	56½	21				42	28"	23	30						53	2⅝	49½	36	1 5/8	1 13/16
44	32	59	22				44	28"	23	31						55¼	2⅝	51¾	40	1 5/8	1⅞
46	33	61½	23				46	30"	24	33						57¼	2 11/16	53¾	40	1 5/8	1 15/16
48	34	64	24				48	32"	26	34						59½	2¾	56	44	1 5/8	2
50	35	66½	25				50	32"	26	35						61¾	2¾	58½	44	1¾	2 1/16
52	37	69	26				52	34"	27	36						64	2⅞	60½	44	1¾	2⅛
54	39	71½	27				54	36"	29	37						66¼	3	62¾	44	1¾	2 3/16
56	41	74	28				56	36"	29	39						68¾	3	65	48	1¾	2¼
58	42	76½	29				58	38"	31	40						71	3⅛	67¼	48	1¾	2 5/16
60	44	79	30				60	40"	33	41						73	3⅛	69¼	52	1¾	2 5/16
62	45	81½	31				62	40"	33	42						75¼	3¼	71¾	52	1⅞	2⅜
64	47	84	32				64	42"	34	44						78	3¼	74	52	1⅞	2 7/16
66	48	86½	33				66	44"	35	45						80	3⅜	76	52	1⅞	2⅝
68	50	89	34				68	44"	35	46						82¼	3⅜	78¼	56	1⅞	2 11/16
70	51	91½	35				70	46"	37	47						84¼	3½	80½	56	1⅞	2¾
72	53	94	36				72	48"	40	48						86½	3½	82½	60	1⅞	2 11/16
74	54	96½	37				74	48"	40	49						88½	3⅝	84½	60	1⅞	2⅞
76	56	99	38				76	50"	42	50						90¾	3⅝	86½	60	1⅞	2 15/16
78	58	101½	39				78	52"	43	52						93	3¾	88¾	60	2	3
80	59	104	40				80	52"	43	53						95¼	3¾	91	60	2	3 1/16
82	60	106½	41				82	54"	44	54						97½	3⅞	93¼	60	2	3⅛
84	62	109	42				84	56"	47	56						99¾	3⅞	95½	64	2	3 3/16
86	63	111½	43				86	56"	47	57						102	4	97¾	64	2	3 1/4
88	65	114	44				88	58"	48	58						104¼	4	100	68	2	3 5/16
90	67	116½	45				90	60"	50	61						106½	4⅛	102¼	68	2⅛	3⅜
92	68	119	46				92	60"	50	62						108¾	4⅛	104½	68	2⅛	3½
94	69	121½	47				94	62"	52	63						111	4¼	106¼	68	2⅛	3 9/16
96	71	124	48				96	64"	53	64						113¼	4¼	108½	68	2¼	3⅝
98	73	126½	49				98	64"	53	65						115½	4⅜	110¾	68	2¼	3 11/16
100	74	129	50				100	66"	55	67						117¾	4⅜	113	68	2¼	3¾

EXTRA HEAVY 250 LBS. WORKING PRESSURE

SIZE	A	B	C	D	E	F	G	Short Body Red Tees & Crosses: Size of Outlets	J	K	Short Body Red. Laterals: Size of Branches	L	M	N	O	Flanges: Diameter	Thickness	Bolts: Diameter of Bolt Circle	Number of Bolts	Diameter of Bolts	Minimum Metal Thickness
1	4	5	2	8½	6½	2										4½	11/16	3¼	4	½	½
1¼	4¼	5½	2½	9½	7¼	2¼										5	¾	3⅝	4	½	½
1½	4½	6	2¾	11	8½	2½										6	13/16	4¼	4	⅝	½
2	5	6½	3	11½	9	2½										6½	⅞	5	4	⅝	½
2½	5½	7	3½	13	10½	2½										7½	1	5⅞	4	¾	9/16
3	6	7⅝	3½	14	11	3	6									8¼	1 1/16	6⅝	8	¾	9/16
3½	6½	8½	4	15½	12½	3	6½									9	1 3/16	7¼	8	¾	5/8
4	7	9	4½	16½	13½	3	7									10	1¼	7⅞	8	¾	5/8
4½	7½	9½	4½	18	14½	3½	7½									10½	1 5/16	8½	8	¾	5/8
5	8	10¼	5	18½	15	3½	8									11	1⅜	9¼	8	¾	11/16
6	8½	11½	5½	21½	17½	4	9									12½	1 7/16	10⅝	12	¾	¾
7	9	12¾	6	23½	19	4½	10									14	1½	11⅞	12	⅞	13/16
8	10	14	6	25½	20½	5	11									15	1⅝	13	12	⅞	13/16
9	10½	15¼	6½	27½	22½	5	11½									16¼	1¾	14	12	1	⅞
10	11½	16½	7	29¼	24	5½	12									17½	1⅞	15¼	16	1	15/16
12	13	19	8	33½	27½	6	14									20½	2	17¾	16	1⅛	1
14	15	21½	8½	37½	31	6½	16									23	2⅛	20¼	20	1⅛	1⅛
15	15½	22¾	9	39½	33	6½	17									24½	2⅜	21½	20	1¼	1 3/16
16	16½	24	9½	42	34½	7½	18									25½	2¼	22½	20	1¼	1¼
18	18	26½	10	45½	37½	8	19	12 inches	14	17	9 inches	34	31	3	32½	28	2⅝	24¾	24	1¼	1⅜
20	19½	29	10½	49	40½	8½	20	14"	15½	18½	10"	37	34	3	36	30½	2½	27	24	1⅜	1½
22	20½	31½	11	53	43½	9½	22	15"	16½	20	10"	40	37	3	39	33	2⅝	29¼	24	1½	1 5/16
24	22½	34	12	57½	47½	10	24	16"	17	21½	12"	44	41	3	43	36	2¾	32	24	1⅝	1⅝
26	24	36½	13				26	18"	19	23						38½	2 13/16	34½	28	1⅝	1 13/16
28	26	39	14				28	18"	19	24						40¾	2 15/16	37	28	1⅝	1⅞
30	27½	41½	15				30	20"	20½	25½						43	3	39¼	28	1¾	2
32	29	44	16				32	20"	20½	26½						45½	3⅛	41½	28	1⅞	2⅛
34	30½	46½	17				34	22"	22	28						47½	3¼	43½	28	1⅞	2¼
36	32½	49	18				36	24"	23½	29½						50	3⅜	46	32	1⅞	2⅜
38	34	51½	19				38	24"	23½	30½						52½	3 7/16	48	32	1⅞	2 7/16
40	35½	54	20				40	26"	25	31½						54½	3 9/16	50¼	36	1⅞	2 9/16
42	37	56½	21				42	28"	26½	33½						57	3 11/16	52¾	36	1⅞	2 11/16
44	39	59	22				44	28"	26½	34½						59½	3¾	55	36	2	2 15/16
46	40½	61½	23				46	30"	27½	35½						61½	3⅞	57¼	40	2	2¼
48	42	64	24				48	32"	29	37½						65	4	60¾	40	2	3

EXPLANATORY NOTES

1. Standard and Extra Heavy Reducing Elbows carry same dimensions center to face as regular Elbows of largest straight size.
2. Standard and Extra Heavy Tees, Crosses and Laterals, reducing on run only, carry same dimensions face to face as largest straight size.
3. If Flanged Fittings for lower working pressure than 125 lbs. are made, they shall conform in all dimensions except thickness of shell, to this standard and shall have the guaranteed working pressure cast on each fitting. Flanges for these fittings must be standard dimensions.
4. Where long turn fittings are specified, it has reference only to Elbows which are made in two center to face dimensions and to be known as Elbows and Long Turn Elbows, the latter being used only when so specified.
5. All standard weight fittings must be guaranteed for 125 lbs. working pressure and extra heavy fittings for 250 lbs. working pressure, and each fitting must have some mark cast on it indicating the maker and guaranteed working steam pressure.
6. All extra heavy fittings and flanges to have a raised surface 1/16" high inside of bolt holes for gaskets. Thickness of flanges and center to face dimensions of fittings include this raised surface.
   Standard weight fittings and flanges to be plain faced.
   Bolt holes to be 1/8" larger in diameter than bolts.
   Bolt holes to straddle center lines.
7. Size of all fittings scheduled indicates inside diameter of ports.
8. Square head bolts with hexagonal nuts are recommended.
9. Double Branch Elbows, Side Outlet Elbows and Side Outlet Tees, whether straight or reducing sizes, carry same dimensions center to face and face to face as regular tees and elbows.
10. Bull Head Tees or Tees increasing on outlet, will have same center to face and face to face dimensions as a straight fitting of the size of the outlet.
11. Tees, Crosses and Laterals 16 inches and smaller, reducing on the outlet, use the same dimensions as straight sizes of the larger port.
    Sizes 18 inches and larger, reducing on the outlet, are made in two lengths depending on the size of the outlet as given in the table of dimensions.
12. For fittings reducing on the run only a long body pattern will always be used.
    Y's are special and made to suit conditions.
    Double Branch Elbows are not made reducing on the run.
13. Steel Flanges, Fittings and Valves are recommended for Superheated Steam.

This schedule, superseding all previous issues, was adopted Mar. 20, 1914, by a Joint Committee of the National Association of Master Steam and Hot Water Fitters, the American Society of Mechanical Engineers and the Committee of Manufacturers on Standardization of Fittings and Valves, and became effective Jan. 1, 1915. All dimensions are in inches. Copies of the original chart, of which this is a reproduction, on heavy paper, 24x36 in., can be secured for $1 by addressing the National Association of Master Steam and Hot Water Fitters, 260 Broadway, New York City.

The Cost of Doing Things

Operating Costs at a Small Mexican Mine

By Roy Hutchins Allen*

The cost of mining with so-called "cheap labor" as compared with skilled American labor has been a topic of frequent discussion; therefore, the following exact costs at a small mine in Mexico may be of interest. The labor employed is entirely native and is under the direction of two Americans. The average daily production is about 100 tons of crude ore. The costs are not considered low, but are representative under the conditions of decreased efficiency of labor that have prevailed since the revolutionary disturbances began in 1910.

A brief description of the mine and methods of operation is necessary in order to make the figures of value.

UNIT COST OF LABOR PER 9-HR. SHIFT

Shift bosses	$1.2425 to 1.86¼	Powder boys	$0.497 to 0.62125
Miners	.7455	Hoistmen	1.2425 to 1.36675
Timbermen	.994	Topmen	.994
Helpers	.7455	Blacksmith	1.36675
Trammers	.7455	Boss ore sorter	1.2425
Underground laborers	.37275 to .62125	Ore sorters	.310625 to .62125
		Surface laborers	.37275 to .62125

UNIT COSTS OF SUPPLIES

Dynamite, 40%, per 50-lb. case	$8.75	Handles, hammer, 32-in., each	.176
Dynamite, 60%, per 50-lb. case	9.95	Handles, pick, 32-in., each	.185 to .219
Fuse, double tape, per 1000 ft.	3.375	Handles, axe, each	.209 to .258
Blasting caps, 5X, per 1000	3.872	Handles, adze, each	.219
Candles, No. 15L, per box of 320	2.623 to 3.255	Nails, wire, per 100 lb.	5.670 to 7.229
Carbide, per 100 lb.	7.229	Bar iron, per lb.	.0384
Pine lumber, sawed, per 1000 ft. b.m.	24.85	Drill steel, ¾-in., octagon, per lb.	.0881 to .0949
Pine lumber, sawed, culls, per 1000 ft. b.m.	19.88	Oils, engine, per gal.	.234
Slabs, per metric ton (2204.6 lb.)	7.207	Oil, gas cylinder, per gal.	.353
Poles, pine, 16 ft. long, 6 in. diameter	.895	Oil, black, for ore cars, per gal.	.199
Poles, pine, 16 ft. long, 7 in. diameter	1.044	Oil, kerosene, per gal.	.236 to .306
Poles, pine, 16 ft. long, 8 in. diameter	1.193	Cup grease, per lb.	.060
Poles, pine, 16 ft. long, 9 in. diameter	1.566	Axle grease, per lb.	.045
Shovels, No. 2 D, each	.810 to .994	Gasoline, per gal.	.2659 to .3106
Picks, A.E. No. 4, each	.477	Coal, blacksmith's, per metric ton	7.207
Picks, A.E. No. 5, each	.508	Ropes (sogas), 40 ft. long, each	.199 to .249
Picks, Collins, No. 5, each	.939	Wheelbarrows, No. 4 A, each	4.722
Hammers, 8-lb., each	.681	Rails, 12-lb., per 15-ft. rail	1.655
Hammers, 6-lb., each	.611	Rail spikes, 3-in., each	.0046
Hammers, 4-lb., each	.464	Corn, per bu. shelled	.832 to 1.138
Axes, each	.820	Wheat straw, per av. ton	9.036 to 13.555
Adzes, each	1.160	Alfalfa, per av. ton	22.60
Handles, hammer, 14-in., each	.070	Electric power for hoist, per kw.-hr.	.05964

The property is in the State of Chihuahua, one mile from the railroad, with which it is connected by a surface tramway and over which the ore is shipped to the smeltery. The vein is continuous, but of irregular width, varying from 10 to 80 ft., and lies between a foot wall of hard, dense rhyolite breccia and a hanging wall of badly broken andesite. A large part of the ore is either soft or cut by many clay seams, so that but a small amount of explosive is required to break it. All drilling is done by hand with ⅞-in. octagon steel. In the stopes 40% dynamite is used, while 60% dynamite is employed in driving drifts and crosscuts in the foot wall. Double-tape fuse and 5X blasting caps are used throughout the mine.

Overhand stoping methods are employed, the stopes being carried up in vertical slices 15 to 24 ft. in width. These stopes are all timbered with square-sets and are filled with waste or low-grade material, the filling being kept to within one floor of the back. The stope sets are framed of round timbers, 7 to 8 in. in diameter at the smaller end of 16-ft. poles, and are lagged with 6-ft. slabs. The posts are 6 ft. 2 in. in height and placed 4 ft. 8 in. center to center, so that one 16-ft. pole is required for a set. Operating tests showed that it was absolutely necessary to fill the stopes and that the timbers need not

COST OF MINING

(a). Cost of Breaking Ore (17,253 tons)

	Labor Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Broken
Shift bosses (part)	236.85	.0138	72.8	$367.89	$0.0213
Miners	3488.33	.2021	4.94	2621.22	.1519
Shovelers in stopes	1382.40	.0802	12.48	828.57	.0480
Powder boys	311.25	.0180	55.4	153.38	.0089
Blacksmiths	163.50	.0095	105.5	187.73	.0109
Total labor	5582.33	.3236	3.09	$4158.79	$0.2410

	Supplies Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Broken
Dynamite, 40%	1194.3 lb.	0.0692	14.49	$208.94	$0.0121
Fuse	7826 ft.	.454	2.20	26.41	.0015
Caps, 5X	4162	.241	4.15	16.11	.0009
Candles, No. 15L	28800	1.67	.60	240.05	.0139
Carbide	98 lb.	.0057	176	7.11	.0004
Drill steel	110 lb.	.0064	155.3	20.08	.0012
Pick steel	3.6 lb.	.0002		.89	.0000
Hammers	4			2.52	.0001
Shovels, No. 2D	34	.0020	507	27.45	.0016
Picks	6	.0004		3.10	.0002
Handles				11.68	.0007
Blacksmith's coal	4090 lb.	.237	4.22	13.37	.0008
Total supplies				$577.71	$0.0334
Total cost of breaking ore				$4736.50	$ .2744

(b.) Cost of Timbering Stopes

	Labor Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Broken
Shaft bosses (share)	52.63	0.00304	327.8	$81.75	$0.0047
Timbermen	662.7	.03842	26.1	664.26	.0385
Helpers	625.25	.03624	27.6	464.64	.0269
Carpenters (contract)	146	.00846	118.1	214.63	.0125
Total labor	1486.58	0.08616	11.61	$1425.28	$0.0826

	Supplies Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Broken
Lumber				$1935.10	$0.1121
Candles, No. 15L	9493	0.556	1.83	78.93	.0046
Axes	3			2.15	.0001
Adzes	2			2.32	.0001
Bar iron	273 lb.	.0158	63.8	10.48	.0006
Nails	205 lb.	.0119	91.7	12.10	0007
Lag screws				2.98	.0002
Washers				1.47	.0001
Ropes, 40-ft.	39	.0023	442	8.77	.0005
Files				2.38	.0001
Total supplies				$2056.62	$0.1191
Total cost of timbering stopes				3481.90	.2017

COST OF UNDERGROUND TRAMMING

(15,531 tons)

	Labor Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Trammed
Shift bosses (share)	26.32	.00169	590	$40.88	$0.0029
Trammers	1217.5	.07839	12.575	911.03	.0647
Total labor	1243.82	.08008	12.486	$951.91	$0.0676

	Supplies Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Trammed
Candles, No. 15L	8800	.567	1.76	$72.61	$0.0051
Axle grease	65 lb.	.00418	239	2.93	.0002
Rails and spikes	30 ft.			3.93	.0003
Total cost of supplies				$79.47	$0.0056
Total cost of underground tramming				1031.38	.0732

*Mining engineer, Jamesburg, N. J.

be larger than those mentioned, though 6-in. poles were not strong enough. Round poles 7 to 8 in. in diameter were as satisfactory as 8x8-in. sawed timbers and cost but half as much. Drift sets are 7 ft. in height and of 8- to 12-in. poles; though, as far as possible, the main drifts are in the hard foot wall, which requires no timbering, crosscuts being driven to the vein at regular intervals.

During the period of seven months covered by these data, all of the ore was broken and trammed by hand, the average tramming distance being 270 ft. With the exception of two development levels, the ore was loaded from shaft pockets into a skip of 23 cu.ft. (three-fourths of a metric ton) capacity and raised to the surface through

COST OF LOADING SKIPS

(18,301 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Loaded
Skip loaders	720	0.03934	25.42	$822.14	$0.0449
Total labor	720	0.03934	25.42	$822.14	$0.0449

Supplies

	Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Loaded
Candles	6995	0.382	2.62	$58.14	$0.0632
Kerosene	4 gal.			1.01	.0001
Torches and wicking				.37	
Total cost of supplies				$59.52	$0.0033
Total cost of loading skips				881.66	.0482

COST OF HOISTING

(18,301 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Hoisted
Hoistmen	378.25	0.02067	48.38	$480.26	$0.0262
Machine work on hoist				89.51	.0049
Total cost of labor				$569.77	$0.0311

Supplies

	Quantity	Quantity per Ton	Tons per Unit	Total Cost	Cost per Ton Hoisted
Valves and pipe fittings				$8.17	$0.0004
White lead				.17	
Engine oil	61.7 gal.	0.00337	297	14.44	.0008
Cylinder oil	41.8 gal.	0.00228	439	14.77	.0008
Cotton waste	79 lb.	.00432	231	6.24	.0003
Grease for skip	131 lb.	0.00716	140	5.85	.0003
Rivets				.23	.0000
Carbide	98.3 lb.	0.00537	186	7.11	.0004
Kerosene	16 gal.	0.00088	1143	4.05	.0002
Torches and wicking				1.48	.0001
Power, electric	6834 kw.-hr.			409.63	.0572
Gasoline	2300 gal.			635.38	
Total cost of supplies				$1107.52	$0.0605
Total cost of hoisting				1677.29	.0916

COST OF DELIVERING ORE FROM HEADFRAME TO PATIO

(18,301 tons)

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Delivered
Topmen	380.5	0.02073	48.10	$353.17	$0.0193
Total labor	380.5	0.02073	48.10	353.17	.0193
Kerosene				$1.02	
Torches and wicking				.37	$0.0001
Rivets				.23	
Total cost of supplies				$1.62	$0.0001
Total cost of delivering ore from headframe to patio				354.79	.0194

SURFACE EXPENSES CHARGED TO COST OF MINING

(15,531 tons)

Labor

	Total Days	Days per Ton	Tons per Man per Day	Total Cost	Cost per Ton Trammed
Laborers	24.5	0.00158	633.9	$14.88	$0.0010
Watchmen	183	.01178	84.87	124.37	.0080
Burro freight				3.18	.0002
Surface trammers (lumber, etc.), contract				51.41	.0033
Total labor				$193.84	$0.0125

Supplies

Tacks				$0.87	$0.0000
Wrenches				2.29	.0001
Express				.97	.0001
Freight				10.04	.0007
Tramway royalties				7.13	.C005
Total cost of supplies				$21.30	$0.0014
Total surface expenses charged to cost of mining				215.14	.0139

COST OF SORTING ORE

(17,019 tons of crude ore)

Labor

	Total Cost	Cost per Ton
Boss ore sorter, 181.1 days	$199.64	$0.0117
Ore sorters (contract)	2004.30	.1179
Screening at R.R. platform	36.22	.0021
Blacksmith	3.23	.0002
Carpenters and helpers	9.91	.0006
Laborers	19.63	.0011
Total cost of labor	$2272.93	$0.1336

Supplies

	Total Cost	Cost per Ton
Hammers	$2.47	$0.0001
Handles	5.00	.0003
Shovels	34.99	.0021
Screens	54.73	.0032
Wheelbarrows	11.33	.0007
Lumber for bins and trestle	26.08	.0015
Nails	2.19	.0001
Bar iron	0.42	.0000
Total cost of supplies	$137.21	$0.0080
Total cost of sorting ore	2410.14	.1416

COST OF DELIVERING SORTED ORE FROM MINE BINS TO RAILROAD PLATFORM

(9363.776 tons)

	Total Cost	Cost per Ton
Trammers (no other labor)	$425.32	$0.0454
Mules (2)	74.92	.0080
Corn	357.06	.0382
Straw	68.51	.0072
Alfalfa	14.85	.0016
Cottonseed meal	2.97	.0003
Bran	1.37	.0001
Mule shoes and nails	6.54	.0007
Harnesses	14.21	.0015
Ropes (40-ft.)	7.34	.0008
Axle grease	.22	.0000
Oil for car wheels	18.91	.0020
Flake graphite	$1.19	$0.0001
Torches and wicking	3.03	.0003
Kerosene	4.27	.0005
Ore sacks	3.48	.0004
Freight on supplies	15.67	.0017
Express on supplies	3.89	.0004
Total cost of supplies	$598.43	$0.0638
Tramway royalties	413.87	.0442
Total cost of delivery	1437.62	.1534

COST OF LOADING ORE INTO RAILROAD CARS

(8882.508 tons)

Labor

	Total Cost	Cost per Ton
Car loaders	$463.14	$0.0521
Transferring ore	9.06	.0010
Total cost of labor	$472.20	$0.0531

Supplies

	Total Cost	Cost per Ton
Shovels	$8.87	$0.0010
Wheelbarrows	2.83	.0003
Tacks	.12	.0000
Total cost of supplies	$11.82	$0.0013
Total cost of loading	484.02	.0544

COST OF SAMPLING AND ASSAYING

(9134.531 tons dry weight)

Labor

	Total Cost	Cost per Ton
Assayer	$350.00	$0.0388
Sampler	131.71	.0146
Total cost of labor	$481.71	$0.0534

Supplies

	Total Cost	Cost per Ton
Gasoline	$64.51	$0.0071
Assay supplies	64.04	.0070
Stove pipe for furnace	.79	.0001
Brooms	.70	.0001
Comparison assays	.99	.0001
Umpire Assays	21.74	.0024
Total cost of supplies	$152.77	$0.0168
Total cost of sampling and assaying	634.48	0.0702
Credit, assays for others	109.64	.0121
Net cost of sampling and assaying	$524.84	$0.0581

DEVELOPMENT

	Total Feet	Total Cost	Cost per Foot — Maximum	Minimum	Average
Drifts	464.57	$1412.74	$3.5217	$1.0671[1]	$3.0409
Crosscuts	363.35	822.02	4.5187[2]	1.2793[3]	2.2623
Raises	47.24	65.53	1.6272	1.0526	1.3873
Totals and averages	875.16	$2300.29	$4.5187	$1.0526	$2.6284

[1] In vein, not timbered.
[2] Through loose boulders.
[3] In vein, not timbered.

The drifts were for the most part in the footwall, a hard, dense rhyolite breccia requiring no timbering. The crosscuts were timbered where they passed through the vein, but not in the foot- or hanging-wall rock. The raises were in the foot wall or in firm vein matter, and required no timbering.

COSTS OF DEVELOPMENT

(875.16 ft.)

	Total Cost	Cost per ft.
Shift bosses (share)	$57.57	$0.0658
Miners	367.53	.4200
Contractors (labor and supplies)	1140.01	1.3026
Timbermen	72.56	0.0829
Helpers	52.93	.0605
Laborers	35.87	.0410
Powder boys	8.52	.0097
Trammers	49.74	.0568
Skip loaders	42.38	.0484
Hoistmen	10.17	.0116
Topmen	$ 7.83	$0.0090
Blacksmiths	40.63	.0464
Total cost of labor and contractor's supplies	$1885.74	$2.1547
Supplies, including lumber	414.55	.4737
Total cost of development	$2300.29	$2.6284

a single-compartment shaft having an inclination of 52°. The average depth from which the ore was raised was 425 ft. on the incline, the least depth being 300 ft. and the greatest 625 ft. During the first two months a 52-hp. electric hoist was used, while during the remaining five months a 22-hp. Fairbanks-Morse gasoline hoist was employed.

The average distance from the headframe to the sorting patio was about 80 ft. On this patio the pieces of ore larger than 4 in. in diameter were broken by hand and the waste and low-grade material thrown out, while the finer ore was screened on a 1⅛-in.-mesh woven-wire screen—the oversize sorted and the fines rejected. About 55% of the ore sorted was thrown into the bins and sent over the tramway to the loading platform at the railroad. Three mules were occupied continuously during the day shift, hauling the ore in trains of two or three cars, each car holding about 1650 lb. of ore. The three mules at work in the morning were replaced at noon by three others, each mule working one-half day six days in the week. The mules were fed morning and night with 2½ liters of corn and 1 liter at noon, and were given all the wheat straw they would eat. The ration was altered occasionally by feeding alfalfa instead of straw and cutting down the amount of corn.

At the railroad platform it was necessary to screen again a part of the ore on account of the considerable amount of moist clay which could not be removed by the screening at the mine patio. This rescreening was included in the cost of sorting. The railroad cars were loaded by wheelbarrow under contract.

The costs given are in United States currency and are calculated from the costs in Mexican currency using the average rate of exchange 0.4970. The weights are in avoirdupois tons of 2000 lb. The figures cover an operating period of seven months in 1912, the mine being closed during the other five months on account of the destruction of the railroad by the native "nonconformists" and the inability to obtain supplies.

Milling at the Nipissing Mines Co.

According to the report of the Nipissing Mines Co. for 1914, there was produced a total of 4,689,333.04 oz. of silver, the gross value of which was $2,516,064.85. The net receipts amounted to $1,587,621.16. The production cost was 19.8c. per oz. Silver sold for an average price of 55.36c. per oz. Shareholders received $1,200,000 in dividends during the year. The ore reserves contain more than 10,000,000 oz. of silver. A summary of shipments in 1914, not including custom production, is shown in the accompanying table.

NIPISSING SHIPMENTS IN 1914

Dry tons shipped	434.2124	Gross silver and cobalt value	$2,221,194.68
Silver contained, oz.	3,999,862.51	Marketing charges	$18,794.06
Gross value of the silver	$2,214,626.60	Net receipts from sales	$2,202,400.62
Average price received per oz., cents	55.365	Total silver produced, oz.	4,689,333.04
Received from sales of cobalt	$6,568.08		

As can be seen, the stock of silver on hand at the mines more than doubled in 1914, probably in some measure due to the difficulty experienced in marketing silver during the continuance of the war. This stock, 1,110,272.15 oz., was taken at a gross value of 48.5c. per oz., and a net value of 47.1c., so that the figures given by the Nipissing company may be considered conservative. In this connection it is interesting to note that the grade of material on hand has increased, along with the quantity—from 3251 oz. per ton on Dec. 31, 1913, to 5364 oz. per ton on Dec. 31, 1914.

The cost of silver production is shown in the accompanying table:

COST OF SILVER AT NIPISSING

Based on production of 4,689,333.04 oz. and 80,037 tons milled.

	Total	Per Ton Ore	Per Oz. Silver
Hydraulicking	$46,578.98	$0.582	$0.0099
Diamond drilling	3,005.00	.037	.0006
Development and exploration	220,799.48	2.759	.0471
Stoping	136,326.32	1.703	.0291
Loading and shipping cr.	1,628.53	.020	.0003
Assaying and engineering	11,571.54	.144	.0025
Administration and office	27,611.09	.345	.0059
Boarding-house and camp maintenance	20,719.94	.259	.0044
Insurance and taxes	37,443.67	.468	.0080
General and legal	23,877.10	.298	.0051
High-grade mill	36,327.17	.454	.0077
Low-grade mill	315,950.59	3.944	.0673
Depreciation	54,242.41	.678	.0116
Marketing product	24,894.48	.311	.0053
Corporation, New York and traveling	13,692.29	.171	.0029
	$971,111.53	$12.133	$0.2071
Less rents and interest	42,667.84	.533	.0091
Total cost of production	$928,443.69	$11.600	$0.1980

The production record for 1914 is shown in the accompanying table:

NIPISSING PRODUCTION IN 1914

	Dry Tons	Silver, Oz.	Gross Value	Net Value
Shipments in 1914	434.2124	3,000,862.51	$2,221,194.68	$2,204,400.62
On hand at mine, Dec. 31, 1914	206.9650	1,110,272.15	538,481.99	523,913.03
	641.1774	5,110,134.66	$2,759,676.67	$2,726,313.65
On hand Dec. 31, 1913	129.4210	420,801.62	243,619.81	239,515.37
	511.7564	4,689,333.04	$2,516,056.86	$2,486,798.28
Difference between estimated and actual returns			7.99	7.99
	511.7564	4,689,333.04	$2,516,064.85	$2,468,806.27

The high-grade mill treated 929 tons of Nipissing ore having an average of 2439 oz. per ton and 965 tons of custom ore averaging 2421 oz. per ton. The refinery treated the precipitates from the low-grade mill. Total shipments of bullion during the year amounted to 6,300,177 fine oz. Total shipments of residues amounted to 1060 tons, giving a net return of $42,344.06. The low-grade mill treated 79,009 tons of ore and 116 tons of byproduct, recovering 2,261,024 oz. of silver, 89.64% of the total content. In the accompanying tables the consumption of supplies and treatment costs at the low-grade mill are given.

CONSUMPTION OF SUPPLIES AT NIPISSING LOW GRADE MILL

	Lb.	Lb. per Ton	Cost per Lb.	Cost per Ton Ore
Cyanide	421,813	5.331	$0.1555	$0.8292
Lime	454,876	5.749	.0042	.0242
Caustic soda	242,014	3.059	.0211	.0647
Aluminum dust	46,836	.592	.3382	.2002
Aluminum plates	41,858	.529	.2467	.1305
Aluminum ingots	13,586	.172	.1925	.0331
Flint pebbles	302,695	3.826	.0084	.0321
Coal for heating	2,532,100	32.001	.0029	.0933
Power, kw.-hr.	4,264,000	53.889	.0118	.6384
				$2.0457

TREATMENT COSTS AT NIPISSING LOW GRADE MILL

	Total Cost	Cost per Ton		Total Cost	Cost per Ton
Crushing at mine	$10,124.44	$0.128	Cyanide treatment	85,130.68	1.706
Aerial tramway	5,142.23	.065	Cyanide filter	10,892.15	.138
Surface tramway	5,469.79	.069	Classifying and precipitation	22,819.56	.288
Picking plant	16,118.17	.204	Refining	8,785.21	.111
Crushing and conveying	3,804.73	.048	Heating	9,317.46	.118
Battery	21,782.20	.275	Water supply	2,878.40	.036
Tube mills and classifiers	45,457.57	.575	Construction	26,437.33	.334
Desulphurizing and slime collecting	24,093.68	.304	Residue dam	4,632.97	.059
Intermediate filtering	8,776.46	.111	Consulting	3,987.56	.050
				$315,650.59	$3.989

Correspondence and Discussion

California Safety Rules

The draft of the safety rules made by the California Commission, published in the JOURNAL of June 12, seems to me to contain some strikingly bad provisions in an otherwise admirable set of safety rules. The fact that the first section of these rules provides that they shall not apply to mines when, in the opinion of the chief mine inspector, they would work an undue hardship on the operator, starts them off with a pernicious provision.

Rules of this sort are necessary or they are unnecessary; and if they are necessary and proper, there should be no discretion left to any one man as to their enforcement.

The compulsory provision for artificial breathing apparatus at each mine employing more than 30 men underground is unwise. The mines at Cripple Creek are the only metal mines in the United States where noxious gases emanate from the ground. In any mine in which there are old workings or workings which have been long submerged the odors from decayed timbers may indicate lack of oxygen in the air and require better ventilation. But rotten timbers certainly do not justify a legal provision for the compulsory furnishing of artificial breathing apparatus, and gases in Cripple Creek mines certainly do not call for legislation on the subject by California. The one general source of danger from dangerous gases in a mine which would require artificial breathing apparatus more at a small mine than at a large one is not touched upon in the rules at all; namely, going back to a round of holes too soon after the shooting. Knockouts by powder smoke are common and frequent, and more so in a small mine than in a large one, because in the larger ones there are more means of ventilation, more system about the shooting and less anxiety on the part of the individual workman about his particular round of shots.

Another section provides that dust from drillings or chutes must be allayed, the necessary devices and appliances therefor being furnished. That is some proposition to put up to the mine operators: "Must be allayed." There are a great many mine operators who would be glad to allay the dust in their mines if somebody would tell them how it can be done. Several of our own drill manufacturers have been struggling with this problem for many years and the South African operators have been working on it still longer, and after a great expenditure of both talent and money the problem is still unsolved for them.

That section which provides that in no case shall explosives be exposed to heat of more than 80 deg. F. will give an officious mine inspector a chance to make a great deal of trouble for the operator. It is 20 deg. lower than the maximum temperature the United States Army regulations allow for their magazines containing dynamite, and while 90 deg. is, 80 deg. is not, a particularly warm day for the sunny side of a mountain slope in California in the middle of summer. The clause making compulsory the use of powder cartridges covered with bright red wrappers is going to cause trouble, mitigated only by the opening section which provides that the mine inspector can abrogate these rules at his discretion.

The section which provides that no explosive that evolves a more noxious gas than gelatin dynamite shall be used, will make almost any mining operator "throw a fit." If this provision is enforced there never will be any more straight dynamite used in mining operations in California. Gelatin dynamite is not always adapted to the blasting problem of a miner, and in general it does not meet the requirements for average mining operations as well as nitro-glycerin dynamite. The one big argument which justifies its use in the face of less-to-be-desired results from nitro-glycerin dynamite is the fact that it produces very much less noxious gas on detonation than does nitro-glycerin dynamite. Straight nitro-glycerin dynamite produces from 26 to 35% of carbon monoxide on detonation and gelatin dynamite produces only about 3%. This provision is therefore equivalent to specifying that nothing but gelatin dynamite shall be used in California mining operations.

New York, N. Y., June 15, 1915. W. R. PERCY.

Finnegan Mines

My attention has been called to a report on the Finnegan and Finnegan Extension Mines, situated at Carson Hill, Calaveras County, Calif., signed "Edwin N. Hawkins, E. M.," and dated Denver, Colo., Oct. 1, 1914. This report contains several unfounded and erroneous statements regarding the Melones Mining Co. which operates the adjoining property, and as the management is quoted as authority for these statements, I wish to correct the false impression which they might cause.

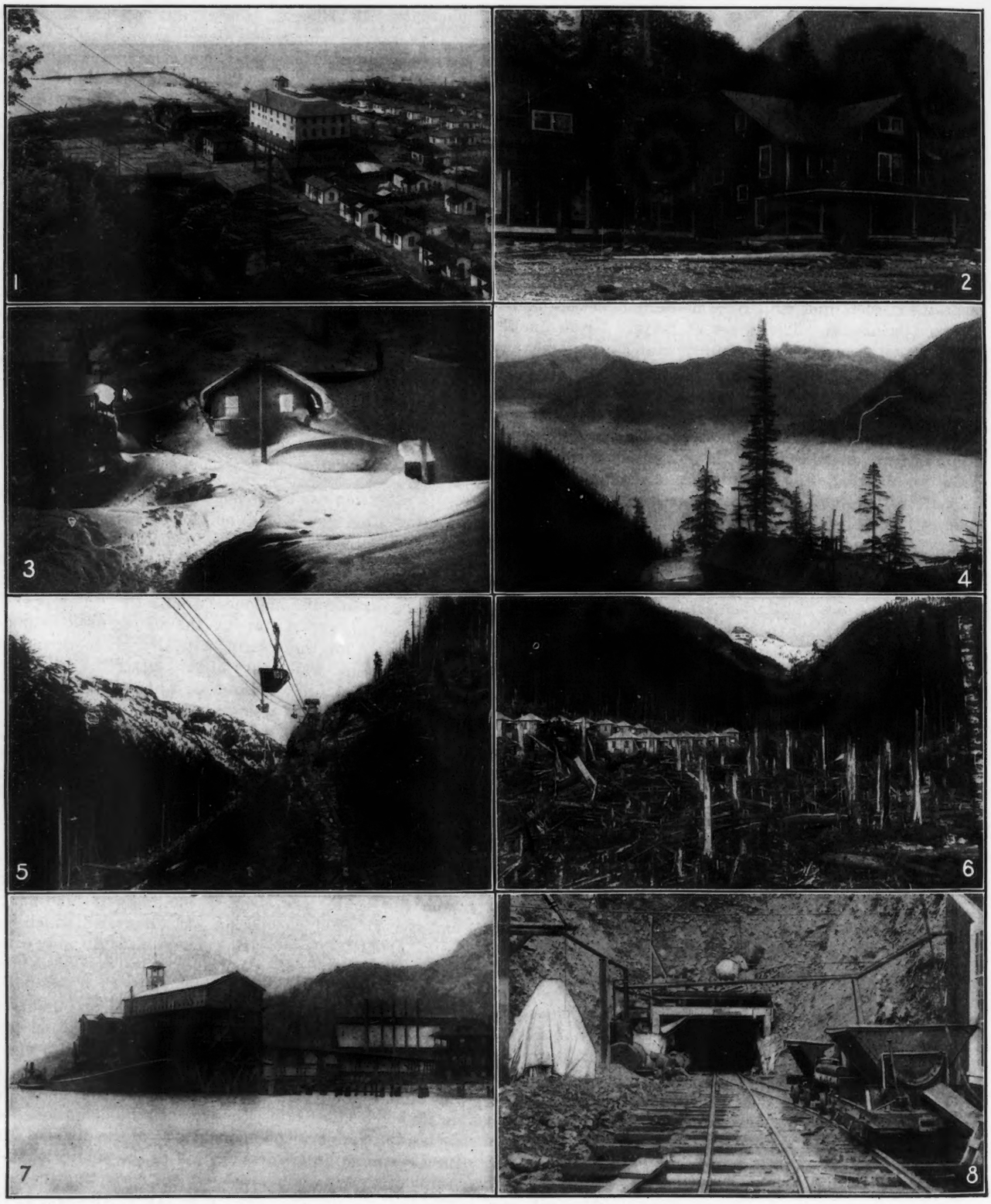
The report states: "It is estimated by the Melones company that it has ore reserves good for 75 years." The Melones company has never had ore reserves of this size at any time in its history and it would be absolutely impossible ever to have them. The company has had ore reserves in sight for as much as three years, but usually has only two years' supply blocked out. It is further stated: "Pocket or nugget value of ore (not included in above, or run of mine ore) is $150,000 to $200,000 annually." As a matter of fact the average annual returns from this source are about $1500, notwithstanding the fact that in 1911 one pocket was discovered which contained about $5000 in coarse gold. This is the only occurrence of the kind of importance since operations were started in 1903.

It is also stated: "Present annual net profits of Melones company, as stated by those in authority at mine and mill, are $400,000." This is untrue and no one in authority ever made such a statement. The Melones Mining Co. has never paid a dividend and has paid no interest on its bonds since 1906; consequently its operations have been unprofitable. The management of the Melones Mining Co. cannot, in fairness to itself or the public, let statements of this character pass without correcting them.

WILLIAM C. DEVEREUX,

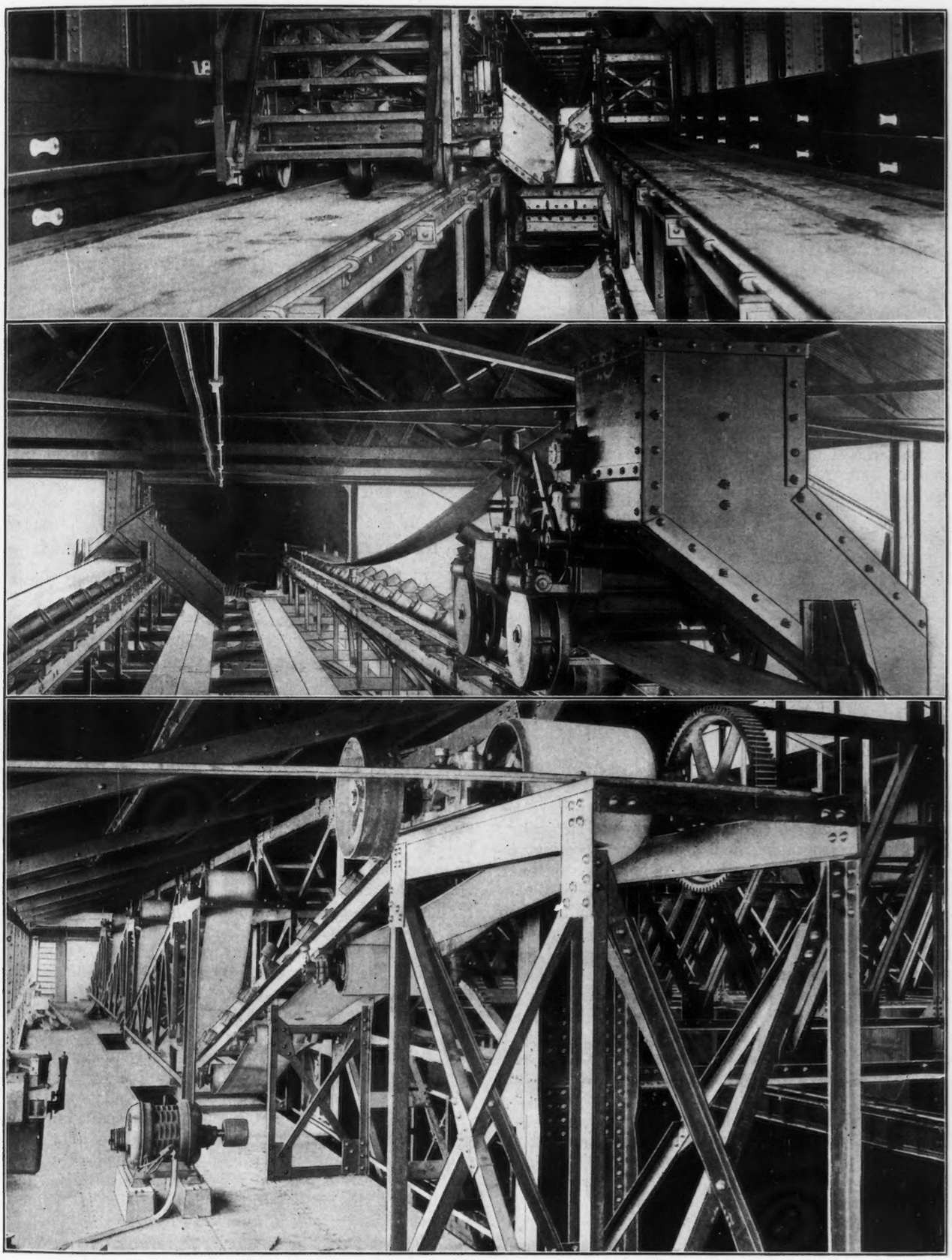
Melones, Calif., June 3, 1915.

Photographs from the Field



BRITANNIA MINES, BRITANNIA BEACH, B. C.

1—Townsite and company store. 2—The hospital. 3—Mountain moonlight in winter. 4—Above the clouds in the upper camp. 5—Aërial tramway from the mine. 6—The beginning of Halfway townsite. 7—Shipping dock and old mill. 8—The 220-ft. adit, 4336 ft. long, main mine entrance.



NEW CONVEYING SYSTEM OF UNITED VERDE COPPER CO., CLARKDALE, ARIZ.

Upper view—Self-propelled feeder supplying conveyor belt. Middle—Fines conveyors with automatic trippers. Lower—Conveyor over silica hoppers. Discharge effected by stationary idlers. The system was supplied by the Webster Mfg. Co., Tiffin, Ohio

A New Era in Mining Education

By Charles F. Willis*

For many years it has been observed that there was something lacking in the methods of mining education; only a few were being served and men were not being trained for other than leadership. Even at that the training was faulty, for the men lacked the distinct training in administration. They also lacked the practical training necessary for the positions in the middle of an organization. The College of Mines of the University of Arizona has put forward a plan, which is the result of several years' observation of the needs of the mining industry, to remedy this.

Workers in the mines, mills and smelteries may be divided into three distinct classes; first, the young man having only a common-school education. These are the men to fit for shift bosses, for floor foremen in the mills, for furnace foremen and the many men on the third to the sixth rungs of the ladder of progress.

The second class includes the young men having an advanced grammar- or high-school training. These are the men who should be trained for mine foremen, mill foremen, and the many positions requiring a partial technical training coupled with sound practical experience. The third class includes the men of scientific institutions being trained expressly for the administrative offices. The work designed by the Arizona College of Mines for the first class is for the man that is unable to attend school for any great length of time. It is a short course in mining, but applied in a totally original manner. There are to be 18 two-week short courses, each subject to be given alone and intensively for two weeks with the theory and practice, lecture and laboratory, and with work in the necessary affiliated subjects. Affiliated subjects will follow each other in regular order and the student may spend two, four, six, eight or any number of weeks, each course being distinctly related to the course before and after it. Instruction will be given in the following order: Elementary mineralogy and blowpipe analysis, elementary surveying, elementary geology and petrography, field geology, prospecting, assaying, cyanidation, concentration, mine blacksmithing, mine timbering, practical mining other than underground, practical underground mining, use and care of rock drills, electricity applied to mining, mechanics applied to mining, gas engines, cost accounting and management and copper-smelting practice.

This system allows for a more efficient training for the men in class 1, giving them a method for more rapid advancement at practically no cost to them. The University of Arizona, being a state institution, can go ahead on these lines where a privately endowed institution cannot.

The method for more efficient preparation for the men of class 2 offered more difficulties. One cannot get far away from the present four-year course of the majority of the mining schools. A too broad training only partially fitted them for the niche they were to fill, while a too practical training was not sufficient to fit them for the work they should be able to do. Here the advantageous geographical position of Tucson was utilized.

The need for class 2 men is not so much an additional quantity of practical training as it is more practical training in successful mines and reduction works, as it is the positions of practical men with theoretical knowledge that they have to fill. During the senior year the classes will attend regular college work for the first half of the week, and the last half of the week will be taken up in the practical application of their theory and taught at successful properties. Cyaniding will be studied at Tombstone, Pearce and Wickenburg; smelting practice at Douglas, Hayden, Globe and Miami; mining methods at Bisbee, Tombstone, Pearce, Ray and many other places. Ore dressing will be observed at Hayden, Globe and Miami; flotation and copper leaching may be studied at Ray, Miami and Ajo. This work will give the student a more practical insight into the industry he is choosing as his profession and allow him to live in the atmosphere of the mining industry. The men represented by class 3 need research and administration in a graduate school, and to this end has been organized the Arizona State Bureau of Mines, a research bureau and a graduate department in mining and engineering administration. The men represented in this group will have passed through the stages of the first and second groups, will have had their practical training and will be ready to specialize and train for the highest positions.

*Director, Arizona State Bureau of Mines, Tucson, Ariz.

Mining Royalties at Cobalt

In the report of the Temiskaming & Northern Ontario Ry. Commission upon the mining industry in that part of northern Ontario served by the Ontario Government Ry., there is an explanation of the royalties payable by certain mines at Cobalt. Since there has been a rather general lack of information on the subject, some excerpts from this report may be of interest.

When the Temiskaming & Northern Ontario Ry. was started, the government placed the management under a commission. The railway was granted a right-of-way and also certain townsites along the line of location. Later on, the government also granted to the railway the minerals underlying the right-of-way and under the townsites except where these had already been disposed of. In the vicinity of Cobalt these mining rights proved valuable in the case of the right-of-way itself and also under the townsites. Instead of undertaking mining operations the railway commission divided its mining lands into convenient lots or parcels and leased them to companies or individuals who acquired them by public tender. In this way four lessees have worked and made returns to the railway. These are the Cobalt Townsite Mining Co., the City of Cobalt Mining Co., the Right of Way Mining Co., and the Nancy Helen Mines, Ltd. The company acquiring a lease paid a cash bonus to begin with, and thereafter a royalty on shipments. Originally the royalty was based on the value of the ore at the collar of the shaft, but this was later changed to a percentage of the net profit. The policy of the commission has been to assist the lessees from time to time by a gradual reduction of royalties as the resources of the mine were exhausted. This has worked out satisfactorily, both to lessor and lessee.

Each lease began by paying 25% royalty on the value of all shipments at the collar of the shaft, with the one exception of the Townsite company, which was supposed to pay 50% royalty on all ore assaying over $1000 per ton and 25% on ore assaying lower than that amount.

This was early considered unsatisfactory, and the uniform royalty of 25% on the gross value was adopted. The next reduction was to 25% net—that is, on profits calculated under what is now called the "Mining Tax Act." Further successive reductions have been to 20%, 17%, 15%, 12½%, 10% and 7½%. On July 1, 1914, all leases from the railway commission were reduced to 7½%, and the agreement now stands that this will be the royalty until Sept. 1, 1915, on which date all royalties will be reduced to 5% on the profits.

The royalties received by the T. & N. O. Ry. Commission from its mining leases up to Oct. 31, 1914, are:

Cobalt Townsite	$270,483
City of Cobalt	100,791
Right-of-way	272,109
Nancy Helen	6,127
Mining Corporation of Canada	8,406
Total	$666,916

A number of other mines at Cobalt pay royalty directly to the government on certain special arrangements, but these have nothing to do with the T. & N. O. Ry. Commission. Thus, when the Crown-Reserve company's mine was sold by the government, a clause was attached to the deed of sale whereby that company paid a certain amount of cash for the property and in addition a royalty of 10% on all ores shipped, the valuation being the gross value at the collar of the shaft. A similar clause was attached to all sales of lots in the Gillies Limit.

The Alleged Zinc Smelters' Combination

The *Boston News Bureau* gives the following summary of conditions:

Attorney-General Parker, of Missouri, has filed an information in the Supreme Court of that state against the 28 companies alleged to be interested in the purchase of zinc ore in the Missouri district, stating he had reasons for believing that they were in an unlawful combination to control prices.

This action is believed to have been brought at the behest of Missouri ore operators who are smarting under what to them is an irritating price margin between the finished spelter and the ore from which it is produced, which at the moment is very greatly in favor of the smelting companies.

The suit is brought against practically every zinc smelter in the United States. In this connection it is interesting to note that back in 1906 Missouri produced 65% of the zinc ore mined in this country, and the ore operators of that state were the dictators of ore prices. In other words, out of 200,000 tons, Missouri produced 130,000. In 1913, however, the total ore production of the United States had grown to 337,000 tons, but of this Missouri produced even less than it did in 1906, or 129,000 tons, or but 30% of the total. [These figures are manifestly erroneous, but the idea that is sought to be conveyed is correct.—Editor.]

In other words, Missouri operators are no longer in control of the price situation and they have combined to fight the smelting companies, with the evident purpose still further to boost the market for Missouri zinc ores, notwithstanding ores have more than doubled in price in the past few months and are now selling for better than $100 per ton.

For a year or two preceding the recent extraordinary rise in spelter there was no spread between ore and spelter sufficient to show a profit to the smelting companies in the purchase of ores. Today the situation is reversed and while ore prices have more than doubled, spelter prices have more than trebled and the ore operators are "peeved."

As a practical matter, when the market for zinc ores advanced beyond $60 per ton, production all over the country was speeded up and the supply of domestic ores and imported ores was very heavy, and with the relative shortage in smelting capacity and the urgent war demand for spelter it was not surprising that ore quotations were unable to keep up with the sensational advance in the "finished material."

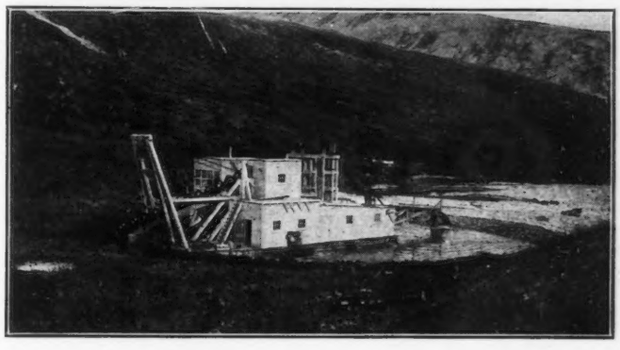
Now the Missouri miners allege that the buyers of ores—the smelters—are grinding the ore producers under the heel of monopoly and have oppressively conspired against them. In the opinion of the Eastern zinc interests the ore producers have not a legal leg to stand on. The idea of a "combination" among the smelters, who are now and always have been in the sharpest competition one with the other, is declared too absurd to be taken seriously.

Flume-Type Elevator Dredges in Alaska

By Lewis H. Eddy*

Two new flume-type bucket-elevator dredges built by the Flume Dredge Co., San Francisco, Calif., at the shops of the Straub Manufacturing Co., Oakdale, Calif., were installed in the Nome country, Alaska, in 1914. One, in the Solomon River district, is owned and operated by C. Flodin. The other, on Arctic Creek, is owned and operated by P. C. Servatius. Machinery and material were shipped from San Francisco and Seattle at the opening of navigation in the spring of 1914. Installation was completed and the boats began digging the first of August, and went into winter quarters in October, having had a profitable season. Operations will be resumed as soon as the ground thaws. The Flume Dredge Co. operates four of its own boats in Alaska, two in the Council district and two in the Solomon River district.

The economic and practical operation of this type of



Flume-Type Dredge, Built in the Solomon River Country, Alaska, in 1914

flume dredge in large areas of placer ground was demonstrated by the first one installed at Melsing Creek, Council district. With some minor changes and by placing the undercurrent within the housing instead of in the flume, the later dredges are identical in construction and are of the same dimensions and equipped with the same size buckets. The hulls are 60 ft. long, 28 ft. wide and 4 ft. deep, with 20-in. freeboard. Flumes are 74 ft. long and 30 in. wide. Buckets are of 2½-cu.ft. capacity, open-link. Riffles are of railroad iron. The undercurrent, built within the housing of the boat, consists of tapping the main flume with 6-ft. grizzlies. The material passing through the grizzlies is conducted to the undercurrent tables, also within the boat housing, which are the ordinary dredge tables provided with heavy screens of expansed metal over planks. Sluice water is furnished by a 12-in. centrifugal pump. The dredges are equipped with Western Gas Engine Co. engines.

Digging Interrupted One Hour for Cleanup

The cleanup is made by running off the coarse gravel; then picking up the concentrates and putting them in the tank; and later running the concentrates through the

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cleanup boxes. This permits a short stop of digging, the cleanup for values being in progress after the digging ladder is again going, the riffles having been replaced in the flume as soon as the undercurrent and tables were cleaned. Digging is interrupted only about one hour for each weekly cleanup. The gold is usually coarse; in some streams quite nuggety, while in other streams there are no nuggets.

The advantages of the flume-type over the screen-type dredge for Alaska placers combine to permit the digging of pay ground only. Shallow draft, small power requirements, absence of mechanical aid in washing the gravel, recovery of the coarse as well as the fine gold, no conveying machinery for distribution of tailings and no water under pressure are the chief features of design and construction accountable for their economical and profitable operation. Lightness and simplicity of structure contribute to economy in upkeep costs, and the small initial cost of construction makes profit possible in placer diggings in Alaska that would otherwise be hazardous. The ground is shallow, from 7 to 12 ft. in depth, where this type of dredge is operated. It is designed for a maximum depth of 14 ft. Greater depth could be dug, if necessary, by reconstruction of the digging ladder. The labor includes three men on a shift. Common labor is paid 50c. per hr.; skilled labor, 62½c. per hr. Distillate costs 20 to 35c. per gal. laid down at the boats. Each boat will use 12,000 gal. in the season.

Freight from San Francisco or Seattle varies from $22 per ton to Solomon River plants, to $60 per ton to Secret Creek. Steamers to the Solomon River country land within 6 to 8 miles of the dredges. Steamers to Council district go up the river for a distance of 65 miles, and from there into the dredging camps transportation is by horse teams. At Solomon there is a railroad up the river carrying freight and passengers. Horses haul the freight cars and dogs haul the passenger cars. Inadequate transportation is responsible for retarding the advancement of the dredge-mining industry. Without such transportation large placer fields will remain undeveloped and unprospected.

John D. Ryan

Adams writes this in the *Boston News Bureau* of a very interesting and popular man in the copper industry:

Friends of the president of the passing Amalgamated declare he knows copper and the vast field it covers not only by long experience, but by intuition. And events of the past eight months go far to affirm their assertion. For no man sensed more opportunely than John D. Ryan this year's astonishing rise in the copper metal. He predicted last December a great reversal in trade conditions, at least in his industry, and his predictions have been made good. Indeed, it is quite likely that, being a modest man, he would frankly admit that recovery has been faster and gone further than he himself anticipated six months ago.

Ryan, by the way, has grown financially and otherwise almost as rapidly since the day he took his place, at the request of the late H. H. Rogers, at the head of Amalgamated's affairs. His corporate connections then were not overnumerous. Now they are both numerous and varied. He is president of several companies and director in many. Those he presides at the head of are Anaconda and Montana Power Co. His directorships, as I have indicated, extend variously. His one railroad is the St. Paul. His industrial companies are the Montana Power Co. and the Tobacco Products Corporation. His banking institutions are the Emigrant Industrial Savings, the Guaranty Trust and the Mechanics & Metals National Bank. His copper-mining companies are Anaconda, Inspiration and Greene-Cananea. So his multifarious official duties keep him busy.

Ryan, on the other hand, keeps himself physically in fine trim to discharge those duties. Big, athletic and in the prime of life, he also has naturally a capacity for work which is the envy of many of his colleagues. One of the latter said to me: "Ryan will go far. With his level head and unlimited vitality he can't help it." Go far? I should say so. Those who know him best insist that he is more ambitious to upbuild the properties he is identified with than he is to build up his personal fortune. He thinks less of himself than he does of his stockholders. And the Montana Power Co. is one of his pet projects. Not only does he hope to make it a big money maker—he desires also to see it a contributor, in a way, to the prosperity of all Montana and of the St. Paul R.R. by furnishing it power at prices lower than power costs in any Eastern center.

Railroad Construction Begun in Alaska

The construction of the Government railroad in Alaska has been begun. The preliminary base of operations is at Ship Creek, on Cook's Inlet. Thence, from tidewater, coal from the Matanuska field is expected to be shipped southward during the greater part of every year. The line, when completed in its entirety, will extend from Seward to Fairbanks, a distance of 471 miles, including the 71 miles of the Alaska Northern Ry., which extends from Seward, through the Kenai Peninsula, to Turnagain Arm. The dock on the right bank of Ship Creek near the mouth is practically completed. This dock is equipped with a 15-ton stiff-leg derrick operated by a hoisting engine, which takes the loads out of the scows in nets or large packages and places them on the dock or flat car. A grid-iron with pile foundation was constructed to furnish level bases for the scows to rest upon when lying alongside the dock at low tide, and by this method lighters are unloaded at all stages of the tide. By utilizing water transportation along the east side of Knik Arm construction may be begun at various points. There is an active construction camp at Eagle River, a point 12 miles up the coast, and another has been started at Peters Creek, a point about 10 miles farther north. Camps will be established along tidewater, close to the railroad line, as fast as the final location is completed and the necessary construction arrangements made. Lieut. Mears reports: "We have now contracted with about 400 stationmen and are employing about 100 men on force account handling the terminal work and constructing wagon roads. I expect to rapidly increase this force to 1500 or 2000 men as fast as material and supplies can be shipped in here to accommodate that number. All of our work is being done by stationmen on a unit basis. Numerous gangs of stationmen have moved into Ship Creek seeking work on the railroad. We have had no difficulty whatsoever in securing all of the stationmen that are required."

Benzol Plants

The United States Steel Corporation has three benzol plants under construction. The plant at Farrell, Penn., is nearing completion and the other two at Gary, Ind., and Birmingham, Ala., will be finished in the fall. The plants now building have a capacity of approximately 26,000 gal. of crude benzol per day, or 9,500,000 gal. per year. The Otto Coking Co., of New York, according to the *Boston News Bureau,* has contracted to build a benzol plant in connection with the byproduct coke works of the Citizens Gas Co., of Indianapolis. This plant is to be in operation in 60 days.

Editorials

New Enterprises in Metallurgy

The last month has been unusually rich in announcements of importance to the metallurgical industry. Among these have been the report of the successful starting of the new system of metallurgy at Anaconda, with strong promise so far that the total extraction of copper is to be raised to some figure above 90% (instead of about 78%, at present); the inauguration of operations at Chuquicamata with so much smoothness as to make the management think it uncanny; and the news that the American Smelting & Refining Co. is going into the tin-smelting business. Of no less importance are the announcements this week that the Anaconda Copper Mining Co. is developing a copper mine in Chile and is contemplating acquiring interests in tin mining in Bolivia; and the official statement that the U. S. Steel Corporation is going to build a new and immense zinc smeltery near Pittsburgh, Penn.

Thus, we have witnessed the inauguration of two new departures in the hydrometallurgy of copper, which promise to be successful and of extraordinary industrial importance. We have witnessed, moreover, the beginning of plans that are going to give the United States a tin-smelting industry, the need for which our metallurgists and industrialists have long been urging. We surmise that the entry into this field by the accomplished, energetic and original metallurgists of the American Smelting & Refining Co., untrammeled by hoary precedents or preconceived ideas, will eventually lead to progress in the metallurgy of tin hitherto unequaled.

The new plans of the U. S. Steel Corporation for zinc smelting near Pittsburgh are of commercial concern, rather than metallurgical. The success of the Grasselli Chemical Co., which has two smelteries at Clarksburg, W. Va., and of the American Zinc & Chemical Co., which has an immense plant at Langeloth, Penn., has demonstrated that the region in the vicinity of Pittsburgh is a suitable locus for a zinc-smelting industry. It may be added that the Mineral Point Zinc Co. is operating a blende-roasting plant at Tiltonville, Ohio, and probably will some day erect distillation furnaces at that place.

The U. S. Steel Corporation is not a newcomer in the zinc-smelting business. It owns all of the capital stock of the Edgar Zinc Co., which for a great many years has operated smelteries at St. Louis, Mo., and at Cherryvale, Kan., works that have been large producers of spelter. Their production, however, has been far below the requirements of the U. S. Steel Corporation, which is the largest galvanizer and the largest single consumer of spelter in the United States. In *ante-bellum* days, in fact, the spelter market was determined more by the U. S. Steel Corporation than by any other single factor. With its buyer in the market for spelter, or out of it, there was apt to be the difference between strength and weakness. The sum that is now to be spent in construction is so large that a plant of great capacity is evidently contemplated. In the trade it is wondered whether the U. S. Steel Corporation is figuring upon the time when its works at Cherryvale (using natural gas) and at St. Louis (an antiquated, uneconomical plant) must be abandoned, or whether it is figuring upon producing its entire requirement of spelter—or whether it is figuring upon both of those things.

If the zinc-smelting capacity of the United States, which is already excessive for normal times—although temporarily strained to its utmost—is to be further expanded, and if the principal consumer of spelter is to disappear from the open market, there will arise questions that will be of supreme importance to all of the concerns that are now engaged in the zinc-smelting business. There is reason to believe that the new plans of the U. S. Steel Corporation are viewed with a great deal of alarm by the smelters.

An Alleged Zinc-Smelting Combination

The action of the Attorney-General of Missouri against the zinc smelters of the United States turned out to be not an indictment, as first reported, but merely the expression of a legal surmise affording grounds for the taking of testimony to find out whether prosecution ought to be instituted. The companies named in the "information" comprise substantially all of the zinc smelters of the United States. This was apparently designed to furnish broad grounds for a "fishing" expedition. Some of the smelters included in the list have not bought any ore in the Joplin district for a long time, while the purchases of a good many others have been relatively insignificant. In fact, out of the 274,000 tons of ore received by smelters from Missouri, Kansas and Oklahoma in 1914, the smelters who made sulphuric acid—chiefly in Illinois—took about 180,000 tons.

"These statistics," we said in an article in the JOURNAL, Mar. 6, 1915, "indicate the predominance of the sulphuric-acid makers in the market for the pure, high-grade ores. They take all the blende of Wisconsin and Tennessee, which they command geographically, and the major part of the production of the Joplin district, from which their competition has practically forced the Kansas and Oklahoma smelters, of whom the Edgar Zinc Co. is the only large buyer of the best sort of Joplin ore."

The action of the Attorney-General of Missouri was manifestly taken at the instigation of the mine operators of the Joplin district, who have long been of the opinion that the smelters buying their ores were acting in collusion to keep prices down. If there were any real ground for such a belief, action would have come more appropriately at a time when prices were low and the miners were being squeezed down to a narrow margin. But on the contrary, the dissatisfaction is expressed at a time when the price for ore had reached the highest figure on record, the complaint then being that the producers were not getting enough.

Everybody of good information knows that among the metallurgical industries of the United States in which unlimited and ruthless competition is rampant, the zinc-smelting industry occupies the first place. European and Australian visitors who have come here to negotiate the sale of ores have recently expressed their surprise at the recklessness of our smelters and the need for concentration and organization among them for the best interest of the industry as a whole. A reason why there has been no such concentration is the ease with which new people could go into the business. About 15 years ago there were some consolidations of isolated groups, but about as fast as anybody was bought out he turned around and built a new plant with the money that he had received from his old one.

The idea of a combination among the zinc smelters of the United States is simply an hallucination.

Classification of Technical Literature

The classification, or filing, of technical literature is an ever-recurring subject, and thus far any discussion of it has left it where it began, in a very unsatisfactory position. The need of a proper system of classification and filing is evidenced by the frequency with which some man, of more temerity than his fellows, spends much time and effort in devising a scheme to fit his needs, which he then publishes for the benefit of his confreres.

Unfortunately, each of these trail-blazers, as he himself usually states, is viewing the problem from his own particular standpoint, and his suggestion, that the expectant reader adapt the same to his own needs, ends with disappointment the hope with which the reading of his article was begun.

All of this is not without fruition, however. Delegates from about 20 national technical and scientific societies have met in the United Engineering Societies Building in New York to discuss this problem and to perfect a permanent organization for the purpose of solving it and preparing a classification of the literature of applied science which may be generally accepted and adopted by these and other organizations. It is now conceded that such a classification is possible, and, if properly prepared, will serve equally well all branches of the engineering profession, thus solving the difficult problem of the individual engineer in his previous solitary effort at filing. A plan is proposed to this organization whereby a central office, presumably located at the Engineering Societies Building, shall collate all the existing classifications and, with the help of specialists in the various national societies interested, compile a general system which, although perhaps not perfect, shall justify general acceptance and adoption.

All of the other national societies will be invited to participate in this work, and they will invite the coöperation of the publishers of technical periodicals. It is suggested that, the classification having been properly worked out, the publishers may be induced to print in connection with each important article the symbol of the appropriate class in the system determined, so that by clipping these articles a file might easily be made which would embrace in one homogeneous system all clippings on all subjects pertaining to technical science. This will greatly lessen the work of filing, which at present is one of the serious drawbacks to a more general adoption of the practice among engineers. Another suggestion made is that the publishers be induced to adopt the practice, now largely followed by many, of beginning an important article only on the right-hand page. This will also facilitate the work of clipping and filing and very much lessen the labor of cross-reference indexing.

Thus, for the first time this big problem is being tackled by enthusiastic men on a coöperative basis, and it bids fair for the first time to be solved in a satisfactory way. This proposition is being handled on broad lines, and the organization will welcome, at the address given, specific suggestions regarding the subject.

The Lackawanna Coal Case

The United States Supreme Court on June 22 rendered a decision reversing that of the lower court in the suit brought by the Government against the Delaware, Lackawanna & Western R.R. Co. In order to comply with the Hepburn amendment or commodities clause of the Interstate Commerce Act, that company organized the Delaware, Lackawanna & Western Coal Sales Co., which buys the coal from the railroad company at the mines and conducts its sale, paying the railroad for transportation. Stock of the new company was sold to the stockholders of the railroad company. The Circuit Court held that this arrangement was a compliance with the terms of the law, and that the railroad divested itself of ownership of the coal before transporting it to market.

The Supreme Court holds that the distinction between the two companies is not sufficient. The coal sales company is managed by an officer of the railroad company, and is an agent bound by a monopolistic contract which prevents it from buying coal from other companies, from dealing in other coal, or from making competitive prices. The opinion of the Supreme Court declared the railroad retained an indirect interest in the coal and, by means of its contract, could control prices at New York. The court plainly indicated that the contract was monopolistic and directed the Government to bring a new proceeding against the Delaware, Lackawanna & Western to stop its alleged unlawful arrangement.

This decision does not necessarily apply to the Reading and Lehigh Valley cases now pending, as the conditions are somewhat different.

The price for lead came down as rapidly as it went up. Important sellers who at the close of one day said, "Oh, this is only a speculators' demoralization, which will not amount to anything, the consumptive demand for lead being so excellent," were themselves the leaders of the decline, with cuts of half a cent or so, the next day. Speculative operators started out to outdo the previous performances in spelter, but found that lead was not so important a "war material" as spelter. In the meanwhile the price for spelter has been experiencing a decline, which may best be characterized as a fadeaway. It went up to 25c. with the accompaniment of a brass band, but is slinking downward as if nobody wanted to hear any more about it. The Wall Street organs are still talking about a natural recession from which there will be a rally to 30c. per lb., "the proper price for spelter," which is to happen "when the buying demand is resumed." However, there is nobody in the business who expects a "comeback."

BY THE WAY

The tremendous rise in the price of zinc is causing cyanide mill men to begin a vigorous research for some substitute. One distinguished mine manager expresses the opinion that many a mill will ultimately turn to electrolytic precipitation. The desilverizers of lead bullion are also telling tales of woe with respect to how the present price for zinc has increased their refining cost.

Gold mining in midair is one of the latest spectacles to which Wall Street was treated, says the New York *Herald.* Suspended in what is known in the language of the sea as a "boatswain's chair," at the end of a rope leading from the roof of a skyscraper, a workman was busily engaged for hours in scraping into buckets gold-laden soot from the flue of the old United States assay office, now being razed.

Unable to buy food from local sources for its employees at Pachuca, the Cia. Real del Monte y Pachuca, through its parent company, the U. S. Smelting, Refining & Mining Co., has appealed to the American Red Cross for aid. Arrangements have been made to forward 25 carloads of corn for the relief of the 4000 employees of the company at Pachuca. Several carloads of grain and provisions contributed by the large packing houses have already been shipped by the American Red Cross for the relief of famine-stricken noncombatants in northern Mexico. On June 15, U. S. Consul Hanna reports having distributed American Red Cross corn to 12,000 starving Mexicans in the vicinity of Monterey.

At the recent annual meeting of the National Wholesale Liquor Dealers' Association, in Cincinnati, Samuel Woolner, its president, remarked in the course of his address: "The persons engaged in the liquor business contend that they are simply supplying a want and a need. The demand is here, otherwise there would be no supply; that the people have an unalienable, inborn and God-given right to their product; that it relieves more misery than it causes; that it produces more joy than sorrow; that it adds to the efficiency instead of taking away from it; that it is a tonic for the body, a stimulant for the body, producing stronger and healthier minds, which is a greater preventive for crime of all kinds, and causes a lesser demand for institutions such as jails and hospitals for the insane, feeble-minded, etc., than would be required under prohibition or total abstinence." We think that Mr. Woolner must be an optimist.

The following prospectus promises us the kind of a fortune we have been looking for. Our natural spirit of unselfishness, however, will not permit us to monopolize it. Hence, we offer to divide the "snap" with JOURNAL readers. Remittances may be sent in our care by dray or auto truck.—EDITOR.

"This proposition consists of 4000 acres of fine West Virginia coal lands, located in Calhoun County, approximately three miles from a railroad. The whole of this acreage is underlain with a seam of excellent steam coal carrying an average of $3 per ton in gold.

"The coal from this property can be utilized in order to supply power to large industrial enterprises near by, and the ashes that remain can be run over amalgam plates and an extraction of 98% of the gold value can be obtained. The remaining residue from the plates consists principally of aluminum oxide, and this can be treated in an electric furnace, thereby producing beautiful synthetic rubies, sapphires, and all other precious gems, whose principal constituent consists of the chemical compound aluminum oxide.

"There seems to be a wonderful monetary future attached to this magnificent opportunity and it only awaits the fine touch and assistance of a few wealthy men to make this property one of the greatest, if not the greatest, revenue producer of the age. The fortunes to be won from this bounteous reserve of Mother Nature shall make the modern fortunes of our mining barons, such as Clark, Haggin, Jackling, seem like ordinary pikers. All we need is a mere bagatelle of $50,000 to place this mine successfully operating. Will you help?"

Another chapter in the Marañon River placer fiasco was begun in Delaware on June 8. On that date the grand jury, at Wilmington, returned a true bill against Raymond McCune for misuse of the mails in connection with the mailing of circulars of the Peru Gold Placers, Inc., and against Charles S. Miller on a charge of conspiracy with McCune and for withholding certain documents that would have led to an earlier examination of the property by the board of directors. Miller was formerly president of the company, and McCune was general manager and the author of the reports in question. As the specific act on which McCune was arrested was the mailing of a circular to a resident of Wilmington, where the corporation has its Delaware headquarters, it was decided by U. S. District Attorney J. P. Neilds to bring an action in that district. The charges were investigated by the grand jury, with the result noted. Some 50 witnesses were subpœnaed, including practically all the directors and 25 residents of Delaware who had received circulars through the mails. The principal witnesses examined by the grand jury were Frank R. Short, the engineer who investigated the property for the directors and reported it to be of no commercial value, and George P. P. Bonnell, who as treasurer went to Peru last year to represent the financial interests of the company and whose letters to directors here hastened the exposure of the worthlessness of the Marañon River placer. McCune's hearing in New York has been postponed until June 29. He has engaged former District Attorney Wise and evidently intends to put up the strongest defense possible to offset the Delaware indictment. Those who bought stock in the public offering of shares of the Peru Gold Placers, Inc., will not suffer a complete loss. The company has no debts, there is some cash in the treasury, and there are still some bills receivable, as the equipment in Peru has been sold, mostly on 90 days' time, to operators of the silver mines at Huallanca, about 30 miles distant from the Marañon placer. Further, it is understood that the directors and officers of the Peru Gold Placers, Inc., have signified their intention to relinquish all claim of participation in the assets, on account of stock bought by them, so that the share of the public therein may be as large as possible.

PERSONALS

John A. Fulton, superintendent at Melones Mine, Melones, Calif., was presented with a daughter on June 12.

D. D. Muir, of the U. S. Smelting, Refining & Mining Co., is in the East consulting on plans for the Ebner mine, at Juneau, Alaska.

A. G. Burrows, of the Ontario Bureau of Mines, is making investigations in the Porcupine District for a forthcoming geological report.

A. A. Hassan, of New York, has made a preliminary examination of the gold deposits in Montgomery County, Md., near Great Falls of the Potomac.

Philip Argall, of Denver, was in London last month and addressed the stockholders of Stratton's Independence, Ltd., of which he is consulting engineer.

Dr. R. Harris for the Canadian Geological Survey is conducting an investigation of the asbestos deposits of Quebec, especially those of the Thetford area.

J. B. McKennan, for a number of years manager of the Minnequa plant of the Colorado Fuel & Iron Co., has been appointed general manager of the company.

John A. Munroe, a well-known mining man of northern Ontario, who was at one time mayor of Elk Lake, and who enlisted with the Princess Patricia regiment, is reported as severely wounded.

Dr. D. D. Cairnes, of the Canadian Geological Survey, has gone to the Yukon to examine an area on the Stewart River including the gold-bearing quartz of Dublin Gulch and the silver-lead deposits near Mayo Lake.

O. E. Lafleur, formerly connected with the Berwind-White Coal Mining Co., has been placed in charge of the coal department of the Harris-Smith Coal & Coke Co., Uniontown, Penn. The company will soon remove its offices to Pittsburgh.

Dr. W. H. Collins of the Geological Survey of Canada will continue his work on the correlation of the pre-Cambrian formations north of Lake Huron, and will start the areal mapping of the Sudbury district and an investigation of the nickel-copper deposits.

Dr. E. L. Bruce will continue his investigations of the ore deposits of Amisk (Beaver) Lake district in northern Manitoba and Saskatchewan for the Canadian Geological Survey and A. McLean will complete the mapping of the Pembina Mountain area near the U. S. boundary.

Samuel W. Cohen has just returned to Cobalt from a three-months' trip to Nicaragua where he was engaged in the examination of gold mines under option to the Crown Reserve Mining Co., Ltd. Assisting Mr. Cohen in the examination were E. L. Steindler, A. Burnett, H. Bischoff and G. Miller.

George E. Farish, who since January has been in New York in connection with the sale of the Humboldt mines, Colorado, left June 17 to examine the Copper Basin group in southern California. Before returning, he will visit the San Francisco fair and also the Derry Ranch placer property at Leadville, Colorado.

Dr. M. E. Wilson will this summer continue the geological examination of the Buckingham area in Quebec for the Geological Survey of Canada, paying particular attention to the deposits of mica, graphite and apatite. Mineralogical investigations in the neighborhood of Templeton will also be carried on by Dr. Auguste Ledoux.

Austin D. Mixsell, who has been made a vice-president of the Bethlehem Steel Co., has reached that post after a period of 18 years in the service of the company, both in the manufacturing and sales departments. He joined the Bethlehem organization in 1897 in the metallurgical department and the five years succeeding were spent there in special steel making and in experimental work. After several years in the openhearth, treatment, forge, rolling mill, foundry and physical laboratory departments, he became chief of the estimating and inspection departments.

Captain Richard Bowden, who has been employed at the Trimountain mine of the Copper Range Consolidated, ever since the first work was done at the property has resigned his position, effective July 1. For a number of years Captain Bowden has been superintendent of the Trimountain property. He has decided to give up mining for a few years at least, although his plans for the future are not finally determined. Captain Bowden's many friends throughout the district will learn with regret that his future plans contemplate a removal from the copper country.

OBITUARY

George D. Roberts, president of the Exploration Oil Co., formerly the United Development Co., died suddenly of heart disease at Coalinga, Calif., June 22. Mr. Roberts was one of the most prominent oil operators in California and resided at Los Angeles. Years ago he was a Wells-Fargo messenger and his car was robbed by the notorious Sontagg and Evans gang in 1892. Roberts, although wounded by the robbers, took part later in running them down and capturing them.

Park Henshaw died at Chico, Calif., June 12, of paralysis of the brain. He was similarly stricken on March 10, 1913, but was believed to have recovered fully. Mr. Henshaw was born near Kahokia, Clark County, Mo., in 1846. As a boy he served in the Confederate Army in the Civil War and went to California in 1864, residing with an uncle near Oroville. Later he returned to Missouri and studied law, then went to California and began practice at Chico where he had lived ever since. Mr. Henshaw was one of the foremost men in Butte County in advancing the industries and was particularly devoted to mining. He was made colonel of a volunteer regiment in the Spanish-American war and served for a year.

Joseph Weissbein, president and manager of the Gold Flat Pittsburg Mines Co., died at Grass Valley, Calif., June 5 in a fire which burned his residence bungalow at the mine. It was believed at the time that he had been killed and the fire started to cover up the crime. Mr. Weissbein went to California in the early seventies from New York and in 1876 with his brother Jacob, established the Weissbein Bros. & Co. Bank. The brothers were owners in the W. Y. O. D. mine when the property was absorbed by the Pennsylvania Gold Mines Co. They were also largely interested in other mining operations. Recently the brothers sold their bank in Grass Valley to the Nevada County Bank and went to San Francisco where they organized a real estate firm, but continued to be interested in mining operations.

S. Gulishambaroff died at Tiflis in the Caucasus, May 14, aged 65 years. He was considered the foremost petroleum expert in Europe. His writings upon a multiplicity of matters associated with the petroleum industry will long remain as among the most valuable contributions to technological literature. As early as 1874 Mr. Gulishambaroff published works upon the petroleum industry of the Caucasus, while in the early eighties, after his first visit to the oilfields of the United States, he wrote his first account of the wonderful developments for oil in the western hemisphere. These comparatively early works were followed by a large number of others, all of which were recognized of such importance as to be translated from Russian into the English, French, Swedish, Dutch, Japanese, Italian, Spanish and Portuguese languages. Mr. Gulishambaroff, who occupied an official position for many years as adviser to the Russian Government on all matters relating to the industry—technical, legal ,and otherwise—completed his studies at the Technical Institute, St. Petersburg, in 1874, after which he devoted himself to technical research connected with the technology, commerce, and industry of Russia. So much a master did he become on the subjects which he took up that he undertook several commissions by the Russian Government to visit foreign countries for the purpose of investigating their economic and industrial conditions, and it was in this connection that he made three visits to America. In the year 1894, Mr. Gulishambaroff published his work upon liquid fuel, which passed through two editions, while three years later, the Imperial Geographical Society presented him with a gold medal for his publication dealing with the world's commerce during the nineteenth century; apart from this, he received many acknowledgments from scientific and technical institutions for the works he had writen and published.

SOCIETIES

American Institute of Mining Engineers—The members of the Minnesota Branch met with those of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, June 7, at Duluth for a two-day session. J. H. Hearding, General Manager of the Oliver Iron Mining Co., reviewed the mining industry of the Minnesota ranges, with the aid of moving pictures; W. N. Ryerson, of the Great Northern Power Co., gave an illustrated talk on his company's plant. Inspection of the new steel plant of Minnesota Steel Co. and the plant of the Universal Portland Cement Co. consumed the remainder of the session.

Editorial Correspondence

SAN FRANCISCO—June 16

Crude Oil Prices at the well for oil of less than 20 deg. gravity has been reduced 5c. per bbl. by the Standard Oil Co. This brings the price for the lower grades down to 32½c. per bbl. The reduction adds to the troubles of the low-gravity producers who had not recovered from the effects upon fuel oil business caused by the European war. The action of the Standard Oil Co. is said to be the result of competitive selling in domestic markets. The Shell Oil Co. has invaded the field covered for years by the Standard, Associated and the Union and these older concerns have been obliged to meet selling prices of the Shell. A year ago the consumer in the San Francisco Bay region paid approximately 75c. per bbl. at the tanks in central supply depots with an average additional charge of 7c. a bbl. for delivery. Many of these consumers are reported to have made contracts with other than the three older companies at 64c. per bbl., deliveries to begin in less than one year after signing contract. It is reported, also, that new business for immediate delivery has been signed up at prices below the rates quoted a year ago. The production of the Shell company in Coalinga district is estimated at more than 12,000 bbl. per day. A large percentage of this production is shut in pending the completion of the company's pipe line to Martinez. This company is not buying large amounts of oil from other producers, so that the reduction in prices paid the producer cannot be charged to the Shell people.

Cancellation of Patents to Oil Lands embracing 6400 acres in Elk Hills district, Kern County, was ordered by Judge Robert S. Bean of Portland, sitting in the U. S. District Court at Los Angeles, on June 11. Action was brought by the Government to regain title to 10 sections of land near McKittrick, which was patented to the defendant corporation under the act of Congress, July 7, 1866. These lands were granted to aid in the construction of the Southern Pacific R.R., mineral lands, except iron and coal, being excepted from the provisions of the grant. The court found that the lands were, at the time of proceedings resulting in the patent, within a known and recognized oil district and had been previously returned by the U. S. Geological Survey as oil-bearing lands. The court held that these lands are rough, broken up and of no value for agricultural purposes or any other purpose than for their oil contents. It was admitted that the statements in the affidavit of Charles Eberlein, that he caused the lands to be carefully examined by agents and employees of the Southern Pacific Co., was untrue. That, at the time the selections were made and the patent issued, officers of the company in charge were conscious that the lands were, if not actually, at least probably oil-bearing, and that the selections were made and strenuously urged to patent for that reason and not because of agricultural value. Nearly two months before the selection was filed Eberlein wrote to Mr. Kruttschnitt, vice-president of the Southern Pacific, saying he expected to tender a selection list covering lands in the township in question within a week or 10 days and asked that the matter be given special attention, to the end that these lands be covered by the proposed patent. In the meantime the Kern Trading & Oil Co. was organized to take over the oil lands of the Southern Pacific and operate them the same as in the fuel department. Without Eberlein's knowledge the lands belonging to the railroad company in the vicinity and adjoining the lands in this dispute were leased to the Kern Trading & Oil Co. The court declared that while no actual discovery of oil within the boundary of these disputed lands had been made, that was not necessary because they were known as oil lands at the time of the proceedings resulting in the patent. The court concluded that the topographical and structural formation and character of the lands and the surrounding area, and their proximity to known oil development to the south and west, and the geological structure and the known surrounding conditions, all clearly show that the land contained mineral-oil deposits of such quality and quantity as would render their extraction profitable and justify expenditure to that end. Willis N. Mills, special counsel for the Government, who made the closing argument before Judge Bean last January is reported to have estimated that the oil contents in the lands thus returned to the Government would supply the U. S. Navy with petroleum fuel for a period of 25 years. The value is said to be about $10,000,000. Another suit involving oil lands in the same area and of much greater value is still pending in the U. S. District Court. The motion of the Southern Pacific Co. to dismiss the action on the ground that the statute of limitations had supervened was recently denied by Judge Benjamin F. Bledsoe.

BUTTE—June 17

Butte Miners Quit Federation—Alleging that in the 20 years of its affiliation with the Western Federation of Miners, it had contributed $1,000,000 to the Federation for which it had not received one cent's worth of benefit, and hinting at irregularities in the handling of strike funds by Federation officers, the Butte Miners Union, the parent organization of the Western Federation of Miners has formerly withdrawn from the Federation, repudiated the contract which existed between the two organizations and ordered its charter returned to Federation headquarters at Denver. The action is the outcome of friction between the Butte Miners Union and the Western Federation which culminated a year ago in the dynamiting of Federation headquarters. Following is a sample of how the daily papers are used to coax recalcitrant miners back into the folds of the old union:

FOR 30 DAYS

For 30 days you can become a member of the Butte miners' union upon payment of one dollar. Members are worth more than dollars. If you are engaged in the mining industry you should be a member of the miners' union. Get in. Get busy. Bring others in. Put Butte on the map again as the best union town in the country, and help to make the miners' organization the bulwark of the toilers.

The day of the union knocker and character assassin has passed in Butte. They are the enemies of every worker—they try to create division and distrust. Such men are doing the work of the detective whether they are paid for it or not.

The union men of Butte today realize how much they need the miners—and the miners need us. Our hand is outstretched to aid them. Today every obstacle in the way of the miners' reorganization is removed, and every labor union in Butte is ready to lend all possible aid. The future of the miners depends upon themselves. United they stand—divided they fall. Which side are you going to take? Do you stand for unity or division? Will you strive to maintain and improve conditions or will you aid in destroying them? Talk is cheap. Show your card.

Every day's work, with copper around the present price, brings you an extra 50 cents per day because of the union contract. That is some of the union's work—you are glad to get the benefits derived from organization. Keep up your union if you want to keep up wages.

The union hall is the place to discuss every grievance and shortcoming of the union. Go there to solve the problems of organized effort; learn to coöperate with others. You and the union will both be the better for it.

Let us profit by the mistakes of the past. Let us take warning from the miserable conditions obtaining in many open-shop communities. Let us unite in rebuilding a miners' union that shall be a credit to the workers, protecting their interests, redressing their grievances, making happier their lives.

In behalf of a happier future, in the interest of all, we urge every worker in the metal mining industry of Butte to join the miners' union. The enrollment book is at the Workingmen's Office in the Carpenters' hall.

You need a union—the union needs you. War is hell—so is the open shop. Let's avoid it. Unite. Do it now.—The Silver Bow Trades and Labor Council Mediation Board.

SALT LAKE CITY—June 18

Utah Alunite Deposits near Marysvale in Piute County are to be developed. The alunite lies principally within the Custer group of claims owned by the Mineral Products Co., which is backed by the American Fertilizer Co. of Chicago, and the United States Smelting, Refining & Mining Co. A 7½-mile Bleichert tramway from the mine to the railroad in Sevier Valley is to be built. Three oil-driven air compressors have been ordered, and development will be started at once, so that the deposits will be well opened up, before the mill, which is to be built, is completed. The Marysvale alunite carries from 9 to 11% potash, the price of which has advanced considerably since potash salts have ceased to come in from Germany. It is used largely in fertilizer. Alumina will be obtained as a byproduct.

Greater Production and Increased Earnings of Utah mines are following from the rise in the price of metals. Bingham and Tintic as well as Park City show increased production. The Utah-Apex, United States Mining, Utah Metal & Tunnel, and Utah Consolidated at Bingham are producing a good tonnage of lead ores. The Utah Copper is working at full

capacity on a better grade of ore than usual. The lead smelteries in the valley are working at capacity. The United States at Midvale has five furnaces on lead ores; the American Smelting & Refining Co. at Murray, five; and the International at Tooele is working all five of its lead furnaces. From 800 to 1250 tons of lead ore daily are being treated at each of the different plants. The smelting capacity is somewhat limited by the amount of ore that can be roasted, as a large percentage of the ores being received are sulphides, with the exception of ores from Tintic and Beaver County, which are principally carbonates. The amount of sulphides which can be roasted at Murray is limited to 500 tons daily by court ruling. Owing to the present high price of lead, it has been proposed to make settlements on non-contract ores on a basis of $4.50 per cwt. and 50% of the advance beyond that price in 90 days. Or it is proposed to split the difference between $4.50 and the present market, and pay cash, which latter plan appears to be most favored by the smelters. Full payment is being made for ores under contract, and on certain desirable smelting ores. Ore is also bid for on the local market. Few new contracts have been signed, as there is much ore on hand, and those contracts at present in force, must be cared for. The accumulated lead ores on hand have been a source of profit. The amount of zinc ores being marketed is relatively limited, as it is difficult to ship these unless they are carbonates and run 30 to 40% or over. Most of the mines are working two shifts, as usual, but are increasing their working forces.

SEATTLE—June 14

Cement Factory at Fairbanks is plan of Henry Ray. Tests on limestone taken from a large bed outcropping on Goldstream near Fox are reported to have been entirely satisfactory. Men will be put to work at once to prepare lime for mortar and it is hoped cement plant will be built later.

The Yukon Gold is sending engineers to the Kenai River country to examine placer ground there said to extend along the river for 11 miles. The advent of the Yukon Gold dredging operations into this part of Alaska is hailed by the northern operators with delight as it indicates an opening up of the vast region of known valuable dredging ground back of Seward. Dredging in a small way has been undertaken in that portion of Alaska before, but not with equipment sufficient to bring big returns.

Recent Reports from Fairbanks are that there is great activity on Ester Creek, the old producer. On 1 Above Discovery, Johnson & Sandstrom have finished sluicing their winter dump and are working from a new shaft. Doolin & Thorsen have struck good pay on 2 Above. George Ray, on 1 Above, is sluicing his winter dump. Short, leaser on part of the Ray ground, is blocking out 60,000 sq.ft. that he plans to mine this summer. Sullivan & Olson are working crew of 40 men and expect to strip 90,000 sq.ft. of bedrock this summer. Webber, now scraping in bottom of winter dump on Discovery, plans to sink new shaft. Max Love & Co., on 1 Below, is driving tunnels. Charley Lynn, on 5 Below, is sluicing tunnel dirt and preparing for summer work.

WALLACE—June 16

Smelting the Coeur d'Alene Ores in the district is the principal topic of conversation and discussion around Wallace at the present time. A local smeltery would have no difficulty in handling the ores which are produced in the districts and all of the local producers including the larger companies desire a local smelting plant which might give them lower treatment charges and would certainly eliminate the long freight haul necessary at present, but the initial cost of a smelting plant to serve this district is so great that no one company seems willing to undertake it and to date there has been no satisfactory coalition to this end. The Hercules is still at a deadlock over the renewal of its smelting contract, and much of the underground equipment has been pulled and the mine has completely closed down. Negotiations have not entirely ceased between the Hercules and the A. S. & R. Co., but there is at present no evidence of an approaching compromise which will reopen the Hercules mine. The Bunker Hill & Sullivan was unable to obtain any concessions from the smelting company and has renewed its old contract without change of rate. When ex-Senator Clark of Montana a few years ago began the development of his Sunset property, his plans were supposed to include the erection of a smeltery on Beaver Creek and this project is now recalled and discussed with interest.

DULUTH—June 19

Ore is Now Moving at a Rapid Rate from the docks at the head of the Lakes, the lowering of the rail rate from the mines to the ports having stimulated the shipments. The Oliver Iron Mining Co. is the heaviest shipper, moving large quantities from all of the Minnesota and Michigan ranges, with the exception of the Cuyuna range where it does not own any mines. From present indications the Oliver will clean up most of the ore that it has in stock in the Lake Superior district, which will mean that it will work its underground properties with larger crews next winter than it did during the winter just passed.

Railway Developments on the Cuyuna Range—The Northern Pacific and Soo Line still continue their struggle for tonnage on the Range. The Soo Line has thus far had the best of it, hauling practically all the ore that has been shipped. but N. P. interests have control of an immense amount of latent tonnage which must eventually place the latter road first. Recent additions to the N. P. list are the Hill Crest and Mahnomen pits, Croft Mine and Barrows Mining Co. shaft. The last named has no connection with the Barrows Mine, until recently operated by M. A. Hanna & Co. It is rumored, with apparently some foundation, that the Soo Line will extend its tracks northward 15 miles into the Emily District. This territory, where considerable tonnage has been shown up, is now without railroad facilities. The Brainerd Chamber of Commerce has started activities to secure an extension of the Soo Line to Brainerd, now an exclusive N. P. point.

LIVINGSTONE, MONT.—June 17

The New World Mining District has received considerable attention and work there new impetus by reason of permission granted by the Government to haul ore by motor truck through Yellowstone Park. The U. S. Geological Survey has been requested to examine the district and has responded with the following tentative promise:

By reference from the office of the Secretary of the Interior, I am in receipt of your letter of May 4 requesting an examination of the New World mining district, Park County, Montana.

A great many requests for examinations of this sort come to the survey which can not be taken up immediately because its staff of geologists and its appropriations are not large enough to enable it to do all of the work that ought to be done. The requests are, however, placed on record and are given careful consideration when plans for field work are taken up. The plans for this season are already well advanced, and it may not be practicable to grant your request at this time. It will, however, be considered in connection with plans for the 1916 field season. I have been much interested in reports of deposits in the area immediately north of Yellowstone Park and can assure you that if at any time a geologist can be spared for the work, he will be detailed to investigate them.

ST. JOHNS, NEWFOUNDLAND—June 17

There Have Been Negotiations toward reviving copper and pyrites mining down around Notre Dame Bay, but nothing has materialized except the efforts by the Cape Copper Co. of London in its continuation of development at Baie Verte. This company has made good profits in the years it has operated in Newfoundland, principally at Tilt Cove where it abandoned its leases a year or two ago. It is hoped in St. Johns that the attempt to establish a big industry at Bay of Islands on the west coast of Newfoundland will be successful. The Newfoundland Products Co. is the name of the organization which will manufacture carbide and other mineral products. Previous attempts to build up copper, oil, and mining businesses on the west coast have failed.

Iron Mining on Bell Island in Conception Bay is proceeding with about half the normal force at work; between the two companies, the Nova Scotia Steel & Coal Co. and the Dominion Iron & Steel Co., 700 men are now employed, which is an improvement over last winter. It is reported that the Nova Scotia company has secured British and American orders for 300,000 tons of ore which is about half of its usual annual output; German orders have of course been cut off by the war. Shipping by ocean steamers is in progress, and to keep full the big ore bins at its shipping piers across the island, the large stockpiles are being drawn from. It is a two-mile tramp across Bell Island, from the mines to the piers, which are situated on deep water on the sheltered side of the island; owing to the high cliffs at that place the ore-bins are constructed in natural excavations in the rock face. The Nova Scotia Co. is not working its submarine mine at this time, nor has it done so since the war began, but is getting it in first-class condition to start when necessary, concreting the roofs and curves and keeping the pumps going constantly. The long slopes and extensive underground workings are well planned and equipped. Their new slope, No. 3, is being rushed ahead by night and day shifts. It is customary in driving these long slopes under the sea, several thousand feet in length and inclined at 8°, to drive two slopes with a narrow pillar of rock between, in order to use one as an "air-shaft" and the other for hoisting. No. 3 slope is now 1600 ft. from collar to face, and is being advanced 50 ft. per week, with the bosses and miners working on a bonus system. The only actual mining being done is at the surface-pits, where the ore outcrops on Bell Island; 600 or 700 tons a day are being mined.

The Mining News

ALASKA

THE SHIPMENTS OF COPPER ORE from Alaska to the United States in May, 1915, were 7649 gross tons, containing 3,525,600 lb. of copper.

TENAS PONTUS (Valdez)—Has resumed operations and big stamp mill near Shoup glacier has started crushing ore which was taken out during winter.

GRANBY MINING (Valdez)—Midas mine owned by this company will start shipping copper ore on aërial tram just completed, and work is being rushed to bring the property up to the highest efficiency.

RADIO CLAIM (Dawson)—Jimmy Lloyd plans to take a one-stamp prospecting mill to this property. Tunnel driven 70 ft. and winze sunk from inner end of this shows small body of ore from which assays of $180 have been obtained.

PEARSON & JOHNSON (Fairbanks)—Pearson & Johnson, laymen on the Cascaden-McCord bench claim, Livengood Creek, are working in pay estimated to average $2.75 per sq.ft. The ground on the adjoining creek claim runs about $1 per foot.

SHAMROCK CREEK (Fairbanks)—Pay going $1.50 per sq.ft. has been found on Shamrock Creek, tributary of middle fork of Big Chena River. Shamrock is in same district as Palmer Creek and Van Curler's Bar, where considerable work has been done in past.

NO. 21 GOLDSTREAM (Fairbanks)—Jim Russel, part owner and layman, has opened up a large block of ground that will be mined this summer. Difficulty previously experienced on account of lack of water during dry season has been obviated by building reservoir at mouth of Queenie Gulch.

HAPPY HOME ASSOCIATION (Fairbanks)—Judge Bunnell in district court at Fairbanks has decided case of George Smith vs. Mike Wagner, Mike Beegler and George Wheeler in favor of defendants. Suit was for title to Happy Home claim on Eva Creek and $15,000 worth of gold dust deposited in banks and had been in court over two years.

LITTLE ELDORADO ASSOCIATION (Fairbanks)—Recent cleanup of Whalley, White & Co., leasers, contained 130 oz. of gold, which was very coarse, largest nugget being worth $57. Present shaft is nearer creek than old workings from which large production was made several years ago. Ground averages about $5 per sq.ft. of bedrock.

DRY CREEK (Shushana City)—New impetus has been given to prospecting of deep channels of Shushana district by discovery of rich pay on Dry Creek, tributary of Johnson. Except in few instances it has been impossible to reach bedrock on account of live water. Shaft in which recent discovery was made struck water at depth of 110 ft. Small drill hole was drilled to bedrock from bottom of shaft—distance of 10 ft. Gold worth about $1 was recovered from 3-in. drill-hole. Since discovery property has been bonded to J. J. Finnegan.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Made a record production for company in May, with output of 5,727,000 lb. of copper.

MASCOT COPPER (Dos Cabezas)—Last spike has been driven in new Mascot & Western R.R., 16-mile line connecting property of this company with main line of Southern Pacific. Company will shortly be in position to begin ore shipments.

COPPER QUEEN (Bisbee)—Is to concrete Sacramento shaft from top to bottom, distance of 1700 ft. Work to be done without interfering in any way with hoisting of ore. Shaft is main outlet for ores mined by company in Bisbee camp and it would not pay to close shaft at this time. Five-foot steel forms have been designed by George Morris, master mechanic, and Capt. J. P. Hodgson, underground superintendent. Is planned to put in 5-ft. section of concrete between every two working shifts. Two eight-hour shifts being worked at present. There is only one other concrete shaft in Bisbee district, that being Junction of Calumet & Arizona, concreted two years ago from surface to bottom at 1800 level.

Gila County

IRON CAP (Globe)—Is shipping 200 tons of 10% ore weekly to smeltery at El Paso. June 14, shipment of high grade to same point was begun with carload that averaged 25% copper, 25 oz. silver, and carried a small amount of gold.

BAKER & FERRYMAN (Roosevelt)—Purchasing supplies for cable ferry to be installed across Salt River to Sunset Camp, at mouth of Buckhorn Cañon, about 4½ miles below Roosevelt dam. A 900-ft. cable will be used and it will be arranged in such a manner that the current will carry the boat and its burden across in either direction.

OLD DOMINION (Globe)—Company has been running two furnaces up to June 10, when third furnace was started, and to date the copper production has been averaging over 40 tons per day. Basic-converter shell, if it runs remainder of month, will have completed campaign of two years without having been off the stand. In concentrator tonnage of over 600 tons per day has been put through all of this month. New type of shaking screen will be installed below trommels at head of mills and in near future extra compartments will be added to Woodbury jigs. Recent changes made in flotation machine have allowed considerable bigger tonnage to be treated. In mine department tonnage hoisted this month has averaged between 900 and 1000 tons per day. Flow of water on 12th level has decreased to about 6,500,000 gal. per day and this decrease has enabled mine to shut down Prescott pump on 10th level, so that all of water is now being handled from 12th level.

Maricopa County

MARICOPA QUICKSILVER (Phœnix)—Is making preparations to resume active development of its property in Mazatzal mountains.

INDEPENDENCE (Wickenburg)—Will install dry concentrator on its lead property west of Vulture mine. Site is now being graded.

SUNFLOWER CINNABAR (Phœnix)—Will resume operations at early date. Retort was installed on property some months ago but furnace may be installed soon.

Mohave County

UNITED EASTERN (Oatman)—Company has acquired water rights for its proposed mill to be built in Kingman District.

Pima County

NEW CORNELIA (Ajo)—Has received authority from Arizona corporation commission to issue $675,000 of securities for constructing proposed Tucson, Cornelia & Gila Bend railway. Contract calls for completion of road Jan. 1, 1916.

Santa Cruz County

DUQUESNE M. & R. (Duquesne)—This copper property belonging to estate of late George Westinghouse is having conducted tests on oil flotation at company's plant at Washington Camp. Charles A. Bankerd is agent for Duquesne company.

CALIFORNIA

Amador County

HARDENBURG (Jackson)—Arrangements being made for settling affairs and to provide money for continuing development and operation. John Martin and Henry Malloch owning the controlling stock in South Eureka Mining Co. are principal stockholders in Hardenburg. They have agreed to turn back one-half of their Hardenburg shares into treasury to be sold and proceeds to be applied on debts and providing of fund for renewed operation. Under this plan all creditors have signed forebearance for six months and to protect them, company is to turn over all its property to C. L. Culbert, manager of the bank of Amador County, as trustee. Property is equipped with 20-stamp mill and is operated through vertical shaft.

Butte County

MORNING STAR (Stirling)—This mine, situated near Romsey Bar, will be reopened by F. W. Foster, of Oakland. Property has been idle about 10 years.

Del Norte County

PLATINUM in black sand along coast in this county near Crescent City is to be recovered by machinery manufactured in San Francisco, according to J. W. Sweet who has been overseeing construction of plant to be installed. It is reported that this method accomplished saving of 84 oz. of platinum during short period last winter. Plant will be operated by gasoline engine.

Eldorado

LARKIN (Diamond Spring)—Property sold to Charles F. Becker, of Sacramento, acting in interests of San Francisco men. Mine is reported to have produced $250,000 in gold from depth of 800 ft. It is believed orebodies persist to greater depth.

Kern County

PACIFIC MINERAL PRODUCTS (Los Angeles)—President Eisenmayer is preparing to make inspection of mineral resources in Mohave desert region. Company is in the market for talc, asbestos, soapstone, ocher, umber, manganese, jasper, molybenite, wolframite, Scotch red, light and black granites, marble, kaolin, feldspar, chrome, fluorspar, barytes, mica, garnets, silica, graphite, magnesite, and non-metallic minerals.

Nevada County

BIRCHVILLE (Graniteville)—Company has appealed from judgment of superior Court which awarded Guiseppa Damiano $12,000 for injuries received in the mine in 1913. Suit was brought for $30,000.

UNION HILL (Grass Valley)—Strike recently made above west drift on 800 level has developed into high-grade deposit of ore. Average width 2½ ft. Drifting east and west is in progress in addition to extracting large amount of high-grade rock; 10 stamps of the 20-stamp mill are kept going on average milling ore.

GOLDEN CENTER (Grass Valley)—Peabody gold mining claim on northwest slope of Gold Hill has been acquired by operators of Golden Center. Peabody was owned by the Peabody Gold Mining Co., of which Baron von Shroeder, now in the German army, is president. Property comprises 14 acres, considered valuable mining ground. This makes holdings of Golden Center about 130 acres. Golden Center recently acquired Catholic Church property of about 14 acres. Mill returns show that ore is running as high as $22 per ton.

Plumas County

ENGELS COPPER (Taylorsville)—Exploration of orebodies will be undertaken with diamond drills. Six machine drills are breaking ore and other drills will be added as soon as new air compressor recently purchased is installed. Purchase of three more motor-trucks is contemplated. One large caterpillar engine and three motor-trucks are at present employed to haul supplies and concentrates. With additional trucks it is estimated that 40 tons of concentrates can be shipped daily. Elmer E. Paxton is manager.

San Bernardino County

CALIFORNIA TRONA (Searles)—Is installing large brine-pumping plant, capacity of 1,200,000 gal. per day. Will also begin construction this summer of 100-ton potash plant on lines of new process worked out in New York. Expected that potash production will begin at Searles Lake in six months at rate of 30 tons per day and during succeeding four months be increased to 100 tons.

San Benito County

PACIFIC (Hollister)—This quicksilver mine has been purchased at bankruptcy sale by Bristow and Huckaby, of San José. Property is equipped with reduction plant which has been out of commission several months. It is expected new owners will reopen mine.

Shasta County

BALAKLALA (Coram)—Repairs of tramway and other surface equipment are in procress and arrangements being made for continuing and probably increasing production. Shipments of high-grade ore continue to Tacoma smeltery. Some development is in progress. No information is at hand as to what company proposes to do regarding resumption of smelting.

Sierra County

CROESUS (Alleghany)—Rebuilding of quartz mill being pushed under contract to Robert Hathaway, of Nevada City. Mining operations also are being continued upon large scale under management of W. B. Pearson.

ORO (Downieville)—Work has been resumed under bond to Dr. G. P. Reynolds and associates, of Alameda. This property contains two gold-bearing veins, one small but very high grade, other assaying $3 to $6 per ton.

CLEVELAND (Sierra City)—Winze being sunk 100 ft. to prospect shoot of $4 to $8 free-milling ore, and 10-stamp mill has been put into operation. R. G. Gillespie, of Pittsburgh, Penn., is operating under bond. Dan McGonigal has charge.

Siskiyou County

BLUE JEANS (Etna)—Siskiyou syndicate has increased crew of miners at this mine, and advanced development at Cub Bear. Installation of a stamp mill is contemplated.

Sonoma County

GREAT EASTERN (Guerneville) — Reported that this quicksilver mine will be reopened immediately, after clearing away accumulation of débris caused by caving of tunnel by earthquake of 1906. High price of quicksilver which is about double what it was at time mine closed down, is inducement for the reopening of the mine.

Trinity County

DELTA CON. (Delta)—Raising funds for building a mill in Dog Creek district.

Yolo County

UNION EXTENSION (Davis)—R. D. Mayes and A. J. Hillhouse, of Dixon, will undertake development work. The 300-ft. shaft will be deepened 100 ft. and two new drifts driven. Mine is equipped with stamp mill.

COLORADO

Clear Creek County

LAMARTINE (Idaho Springs)—Lindall-Eckberg Leasing Co. has opened 3-ft. vein of $15 ore.

NEW ERA (Idaho Springs)—Underground development being carried on in three headings. Veins are from two to three feet wide and assay about $30 per ton. Ore from old dumps is being run through mill. Averages about $5 per ton. Estimated that there are about 10,000 tons available.

ONEIDA-STAG (Idaho Springs)—In west workings 600 ft. below surface vein of smelting ore has been opened that averages 30 in. in width and assays 1.12 oz. gold and 3 oz. silver per ton. During last month mill has been running on ore produced from development work, averaging from $3 to $5 per ton, and paying cost of mining and milling. Will install new compressor plant. H. T. Rogers is local manager.

VINDICATOR MINES & TUNNEL (Idaho Springs)—Leasing company to be known as the Gold Standard Leasing Co. will be organized to take over and operate properties of Vindicator company. Contract has been let to advance drift on Tom Tuck vein to its intersection with Gold Leaf vein. Recent development on Tom Tuck vein has opened ore averaging $10 per ton in vein 6 ft. wide.

STANLEY (Idaho Springs)—First 1500 ft. of Road Adit level recently repaired and retimbered preparatory to additional development work through this level. At Salisbury Mill, Thomas Egan, leaser, is successfully treating ore from Stanley dumps averaging $2.40 per ton. Material is crushed in a 10-stamp battery to 40 mesh, passed over amalgamating plates, 16-ft. Wilfley table and two Egan concentrators. The recovery amounts to 71c. by amalgamation and $1.22 by concentration, or total of $1.93 per ton. Total operating cost is about $1.25 per ton. Improvements will be made in process and tonnage will be increased.

CONNECTICUT

New London County

LANTERN HILL SILEX (North Stonington)—Property acquired by H. G. Mayham, of New York and compressed air plant and mining equipment will be installed and production resumed. Spur will be built and rock shipped via Mystic.

IDAHO

Custer County

LOST PACKER MINE (Mackay)—Will install 50-ton flotation plant immediately to treat siliceous ores that have heretofore been too expensive to flux in company's smelting plant. Property is controlled largely by Salt Lake men.

Shoshone County

RED MONARCH (Wallace)—Has purchased oil-engine and compressor and will resume mining operations at once. Property adjoins Interstate-Callahan. Ralph Smith is manager.

FRISCO (Wallace)—Work on 6000-ft. flume carrying water for 600 hp. and also for milling purposes, will be completed soon, at which time working force will be increased to 200 men.

MARSH (Burke)—Full operations including sinking of shaft have been resumed at Marsh mine. All equipment in leased mill completely overhauled and in some cases old machinery discarded and replaced with modern.

STEWART (Stewart)—Net earnings for May, $73,000. Producing 15,000 tons of ore per month. Concentrates shipped to A. S. & R. contain between 40 and 50 oz. silver per ton and 50% lead. Company now has between 1700 and 1800 stockholders, largest number in its history.

PANDORA (Wallace)—Has petitioned court for dismissal of case recently filed by it against Snowstorm mine, requesting survey of underground workings on account of allegations that Snowstorm had penetrated Pandora ground and extracted ore. Satisfactory arrangements between two companies for survey have been made.

MARYLAND

Montgomery County

GREAT FALLS MINES (Potomac)—Is shipping gold ore valued at $20 to $35 per ton after sorting. Contemplates building 25-ton mill. C. L. Logue, formerly of Manhattan and Goldfield, is superintendent.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Is slowly adding to the force at No. 3 and 4.

SUPERIOR (Houghton)—There has been slight increase in output of copper, tonnage running 650 lately.

FRANKLIN (Houghton)—Tonnage of rock from Allouez conglomerate lode at this property now reaches 750 tons daily.

TAMARACK (Calumet)—Has increased daily rock tonnage to 1100 tons which rate will be maintained for at least two months.

LAKE (Houghton)—No shipments yet made at Lake where unwatering is proceeding as rapidly as possible. Similar conditions prevail at La Salle.

HANCOCK CONSOLIDATED (Hancock)—Rock shipments gradually increasing; now average from 15 to 17 cars every other day. This has been maintained since first of month.

MOHAWK (Mohawk)—Foundation for new steel rock house at No. 5 completed. Work starts immediately to erect new building. Old wooden rockhouse is torn down.

MICHIGAN (Houghton)—Question of milling opportunities in district is likely to become serious soon if present demand for metal continues. Michigan mill, which never operated, would require but little overhauling to put it in good condition to handle amygdaloidal rock.

NEW ARCADIAN (Houghton)—Outside of discovey of No. 8 conglomerate at New Arcadian, opening of copper rock in southerly lateral at 900-ft. level is most important development in history of operations by present management. North openings in amygdaloid have been satisfactory and are showing continuous high-grade stamp rock.

CONTACT (Houghton)—Resumption of operations at Elm River or Contact property will commence immediately. Elm River originally organized years ago and large amount of money spent unsuccessfully. New company has been organized to take over property and exploration work along new lines will start. Recent assessment of 50c. will provide funds for drilling work which will be undertaken in northeast corner of Section III.

Iron

CHASE (Ishpeming)—Mine about to be closed; ore supply is exhausted. Equipment will be moved. Chase was opened five years ago. Tonnage mined has been small.

CHATHAM (Iron River)—No ore has been shipped from here this year. Ore is still being stocked. This is unusual at this time of year. Ore is usually dumped into cars during shipping season even if stockpiles are not moved.

BALKAN (Alpha)—Winston Bros. have been given contract to mine 200,000 tons of ore from Balkan pit this summer. Same company is doing stripping. Drag lines will be used. Only 100,000 tons will be shipped; remainder will be placed in stock.

NORTH LAKE (Ishpeming)—All records for drifting on the Marquette range have been broken at this property. A rock drift over 4000 ft. long is being run. During May the footage was over 400 ft. Two crews of men are working eight hour shifts. There is no Sunday work. Only two drills are employed. Rock has to be trammed long distance. Is one of finest pieces of drifting work on range.

NEWPORT (Ironwood)—Has lost its suit in supreme court regarding its mine valuations. Taxes were paid under protest after Finlay valuation. Company maintained that lands which were thought to contain large ore reserves were assessed at too high a figure, as it was not known what ore was present there. Court held that if company desired to sell lands in question that large price would be asked for them and that valuation was not placed at too high figure. Similar cases are now pending in court but will probably be decided against the companies.

MINNESOTA

Cuyuna Range

IRON MOUNTAIN (Manganese)—Drift on 130 level in about 50 ft. has encountered iron ore running up to 32% Mn.

BARROWS (Barrows)—Work preliminary to shaft sinking is under way. Shaft will be drop shaft of steel and concrete. A 24-ton cutting shoe will be used. Northern Pacific spur now on property. Many innovations in shaft sinking to be tried.

Mesabi Range

MORTON (Hibbing)—Operations commenced underground on June 14. Mine closed since first of year. More than 50 men were put to work. More will be added as work goes on.

MONTANA

Madison County

CONREY PLACER (Ruby)—Machine shop and all machinery total loss from fire June 15. Loss estimated at $125,000. Manager Kammerer announces that shop will be rebuilt and machinery replaced but not on as extensive scale as before.

Silver Bow County

DAVIS-DALY (Butte)—Has drifted 55 ft. on new vein cut on 2500 level. Orebody holds about 11 ft. wide and averages 7.1% copper.

ANACONDA (Butte)—Original mine of this company which has been shut down for several weeks, resumed operations June 11, and about 450 additional men have been put to work. This will add about 1000 tons of ore per day to company's output. During shut-down needed repairs were made but particular attention was given to development work and large additional orebodies have been blocked out. Belmont mine, which has been down for several months, will start operations within few days. This will mean adding at least 150 men to working force and will also add to daily production of ore between 250 and 300 tons. During shut-down, shaft has been sunk 200 ft. further and skips have been put in. Belmont is most southerly mine of company in Butte district. The following awards were made to the Anaconda company on its display at the Panama-Pacific Exposition at San Francisco: 1. Gold medal of honor—Exhibit of copper from mine to finished product. 2. Gold medal—Ore specimens from Butte district. 3. Gold medal—Geological maps, mine models, etc. 4. Silver medal—Models of timbering and vein system. 5. Silver medal—Collaborators under award No. 1. 6. Gold medal—Collaborator connected with exhibit, F. A. Linforth. 7. Gold medal—Collaborator, George W. Pierce.

NEVADA

Churchill County

BARON (Eagleville)—Recent sampling of property has satisfied owners that property deserves mill, and 10-stamp mill will be provided immediately.

Esmeralda County

SANDSTORM-KENDALL (Goldfield)—Electric hoist installed at winze from 500 level and work will be resumed.

SILVER PICK CONSOLIDATED (Goldfield)—Main shaft now 700 ft. deep; east crosscut being driven to cut vein opened on 500 level.

GREAT BEND (Goldfield)—New surface plant now in operation and shaft being unwatered to 500 level. Rich ore was exposed on this level by leasers who were driven out by water.

GOLD COIN (Klondyke)—Shoot of mineralized rhyolite, 12 to 18 in. wide, assaying $90 per ton opened recently. Mineralized zone 12 to 15 ft. wide with narrow seams of high-grade ore.

ORIGINAL KLONDYKE (Klondyke)—Brandon & Miller have taken lease on this mine, located about 15 miles south of Tonopah, which was mined intermittently before Tonopah and Goldfield were discovered.

Lincoln County

PIOCHE ORE SHIPMENTS to Utah smelteries for week ended June 13 amounted to 56 cars estimated 2800 tons, valued at $35,000, compared with 80 cars week previous. Prince Con. shipped 52 cars; Pioche Amalgamated, 2; and Bristol Con. leasers 2.

NEVADA-UTAH (Pioche)—Test of 10-ton lot of ore at experimental plant of Salt Lake Engineering Works gave good results which presage early construction of mill at property.

Lyon County

MASON VALLEY (Thompson)—Stated leaching plant will be ready for operation in few days, capacity 100 tons daily.

Nye County

TONOPAH ORE PRODUCTION for week ended June 12 amounted to 10,392 tons, valued at $213,016, compared with 10,645 tons at $217,570 week previous. Producers were: Tonopah Belmont, 3522; Tonopah Mining, 2750; Tonopah Extension, 1790; West End, 775; Jim Butler, 1100; Tonopah Merger, 351; miscellaneous leasers 104 tons.

NEW MEXICO

Grant County

PINOS ALTOS M. & M. (Pinos Altos)—New mill recently tested with satisfactory results will soon begin receiving custom ore.

SILVER CELL MINING & SMELTING (Pinos Altos)—Has started remodeling smeltery which will immediately be put into commission. Large quantity of ore blocked out in mine and negotiations are being made for purchase of suitable fluxing ore. C. E. Dimmick is manager.

DEVELOPMENT UNDER WAY on several copper mines in Fierro district. Shipments being made occasionally. Humbolt mine of Hermosa Copper Co., under lease to Nelson, Page & Smith. Kresgy mine being operated by J. Sinks. One shipment made to El Paso smeltery. Minters & Atteberry are shipping copper ore to Douglas, Ariz., from Burney mine. G. W. Hightower shipping to El Paso. Other prospects at Fierro being opened up. No activity at Phelps-Dodge property or C. F. & I. Co. mines.

UTAH

Beaver County

BEAVER HORSESHOE GOLD (Beaver City)—Articles of incorporation have been filed. Capitalization is $250,000; company owns claims 14 miles east of Beaver City. H. B. Ward is president.

Juab County

TINTIC ORE SHIPMENTS for week ended June 12 were 124 cars estimated 6200 tons at $155,000 compared to 116 cars week previous.

IRON BLOSSOM (Silver City)—Winze 150 ft. deep has opened cave below 600 level of No. 3 shaft. There is lead and copper staining in bottom. Development looked upon as favorable, as ore has been mined in this section on upper levels, though there have so far been no important orebodies opened at depth.

MAY DAY (Eureka)—Another contract has been made to ship zinc ore, and shipments will amount to about 250 tons monthly. About 30 leasers are working on ore of this character. Will ship about 10 cars of lead-silver ore monthly. In May shipments of zinc ore amounted to $14,892, and lead ore from ground leased from Chief Consolidated brought $5028.

Salt Lake County

PRICE (Salt Lake City)—Will install electrically-driven air compressor and air drills as soon as transmission line now under construction is ready to deliver power.

COLUMBUS EXTENSION (Alta)—John F. Cowan has sold his interest in the property to party to whom he gave option shortly after he became interested in the Bannack Cons. at Bannack, Montana.

OHIO COPPER (Bingham)—Work in the mine has been started. One section of mill will be started first, to be followed by other sections. It is proposed to treat 2000 tons daily, with 250 men employed. Alfred Frank is president of leasing company.

UTAH METAL & TUNNEL (Bingham)—Oreshoot recently opened in tunnel continues to produce from two to three cars of ore daily from development; it has been followed for 200 ft. in length, with width still undetermined. Grade of ore when first opened $20 to $22 per ton is becoming higher; and gross earnings, at rate of one car daily, amount to $30,000 a month.

Summit County

PARK CITY ORE SHIPMENTS for week ended June 12 were 1622 tons valued at $69,000 compared with 1740 tons week previous.

BIG FOUR EXPLORATION (Park City)—Work of installing mill on Poison creek is progressing.

REVELATOR (Park City)—Streak of high-grade silver-lead ore 2 to 10 in. wide, carrying gold and copper opened on 150 level—deepest level—has been followed 31 ft. Ore occurs on contact between quartzite and limestone; and intersection of this contact with mineralizing fissure is looked for within next 50 ft. of work.

CANADA

Ontario

PORCUPINE CROWN (Porcupine)—Nineteen thousand tons of tailings valued at $3.50 per ton produced from the original experimental plant are being retreated.

WHITE RESERVE (Maple Mountain District)—This property, after being closed for two years, is being worked by syndicate headed by J. A. McAndrews, of Toronto.

HUDSON BAY (Cobalt)—Six hundred feet of crosscutting will be done on property at southwest boundary of town of Cobalt. There is large area of conglomerate in this locality which has not been thoroughly prospected.

SCHUMACHER (Schumacher)—Construction of mill has been completed and all machinery ordered. One of veins found by diamond drilling has been reached by crosscutting. It is 4 ft. wide and of good grade.

BURNSIDE (Kirkland Lake)—Charles E. Henrotin, a mining engineer, is suing C. A. Foster, Henry Cecil and Burnside Gold Mining Co. for $150,000, being 7½% of stock of company. Henrotin claims this amount under an agreement whereby he handed over options on property to the company. Burnside company has entered counter-claim against Henrotin for $50,000 damages.

HOLLINGER (Timmins)—Statement for four-weekly period ended May 20 shows gross profits of $139,187 from treatment of 23,821 tons of ore, average value of $9.56 per ton; working costs being $3.54 per ton milled. Earnings and ore values considerably below average, accounted for by power shortage this spring, in consequence of which development was retarded. Subsequently in trying to catch up with development much ore of inferior grade was extracted which resulted in reduction in average value of ore treated.

MEXICO

A. S. & R. CO.—On account of high price of lead will blow in smelteries at Monterey and Matehuala. Chihuahua plant has been in operation for some time; four furnaces now running, fifth will be started soon. Aguascalientes plant will not be started at present time. All these plants produce some copper but will operate now principally on lead ores.

SOUTH AMERICA

Chile

CHILE COPPER (Chuquicamata)—Cable advices state as certain, increase of present ores reserves of 303,303,000 to 400,000,000 tons without exhausting possibilities of property. New 10,000-ton mill which started May 18 expected to be running at full capacity by Jan 1. Plans completed for increasing capacity to 30,000 tons per day. On basis of treating 10,000 tons, cost is estimated at $2.106 per ton, and a cost per pound delivered in Europe or the United States of 5.853c. per lb.

The Market Report

Metal Markets

NEW YORK—June 23

All of the principal metals, except tin, were dull and declining during the last week. In lead there was something akin to demoralization, while in spelter there was a quiet recession of several cents a pound. Copper on the other hand was relatively steady.

Copper, Tin, Lead and Zinc

Copper—Following the large buying of the first half of June there was a natural lull and a recession in prices upon the offerings of interests that want to sell all the time. A considerable business during the week was reported, although the aggregate was much less than the rate of production. The leading interests maintained their price of 20¼c., regular terms, while others sold at 19⅞@20c., r.t., in the early part of the week, and later 19.50@19.55c., cash, New York, was accepted for export business, and toward the close as low as 19.45c. This reflected some difference of opinion respecting the statistical position, it being held in some quarters that it has become somewhat impaired, while in other quarters it is believed to be as strong as ever. The position of the market at present is that if sellers must dispose of copper they have to offer it down, while if buyers want it they must pay nearly the top price.

It is stated, on reliable authority, that the Anaconda company has sold 10% of its expected output in 1916, at upward of 20c. per lb., regular terms, for delivery during various periods of 1916.

Visible Stocks of Copper in Europe on June 15 are reported as follows: Great Britain, 23,104; France, 2570; afloat from Chile, 550; afloat from Australia, 4000; total, 30,224 long tons, an increase of 1255 tons over the May 31 report.

Copper Sheets are understood to have brought 25@26c. per lb. The principal manufacturer has withdrawn all quotations. Wire is quoted at 21@21½c. per lb. at mill.

Tin—The market exhibited no material fluctuations during the week.

Tin shipments from the Straits in May were 6550 long tons. For the five months ended May 31 the shipments were 27,785 tons in 1914, and 26,599 tons in 1915; a decrease of 1186 tons, or 4.3% this year.

Receipts of tin ore and concentrates at Liverpool during May are reported by H. A. Watson & Co., as follows: Bolivia, 3956 tons ore and 195 tons bars; Nigeria, 292 tons ore; South Africa, 140 tons ore; total, 4388 tons ore and 195 tons bars, equal to 2872 tons tin.

Lead—At the close of our last week of record the price of the A. S. & R. Co. was 7c. On June 17 it cut to 6¼c.; the next day to 6c.; and the next day to 5¾c. Each of these reductions was anticipated in the outside market, on June 17 there being sales at 6¼c. at the opening and 5¾c. at the closing, and thus also on following days. The aggregate of business during the week, so far as reported by producers, was small. Producers in general are well sold, and the market of last week was determined chiefly by offerings from second hands. The question for the immediate future is with respect to how much speculative lead there is yet to come out. Until there is further light on that subject the producers will probably make no further move. Toward the close of the week there were some large inquiries from abroad in the market.

On June 22 cable dispatches from London reported the disruption of the international lead convention owing to the secession of the Australian producers, who will sell their own product beginning with July.

Spelter—The price for spelter continued to drift downward during the week, but on the decline a larger tonnage of business was reported than during the previous week, this including some 500-ton lots. In the main the business was for early deliveries, but some contracts for deliveries late in the year were made. A little export business was done. The state of the British and French markets did not, however, permit much of this. According to cable advices early in the week the British government is now fully supplied with its requirements for spelter until next spring, while British galvanizers are operating at only 15 to 20% of normal. Later advices from London reported "nobody interested at any price." The London daily quotation is purely nominal.

Zinc Sheets are lower; base price $27 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Usual extras charged.

Butte & Superior's production of blende concentrates in May was 11,870 tons, averaging 52.11% Zn.

Exports from Baltimore for the past week included 143,600 lb. spelter and 342,110 lb. zinc dross to Liverpool.

"Five cents for No. 28 galvanized sheets is prohibitive for some uses, but that is now the usual minimum," says the "Journal of Commerce." "Long terne sheets as well as painted black sheets are offered as substitutes. Failures to carry out sheet contracts based on 8c. spelter have caused an upheaval in the trade."

DAILY PRICES OF METALS IN NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb	Spot, Cts. per Lb	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
17	4.7638	49⅛	19.55 @19.80	41	5.75 @6.25	5.67½ @6.17½	18.50 @20.00
18	4.7650	49⅛	19.55 @19.80	41	5.75 @6.00	5.62½ @5.92½	18.00 @19.00
19	4.7625	49⅛	19.50 @19.80	41	5.50 @5.75	5.35 @5.60	17.00 @18.00
21	4.7625	49	19.50 @19.80	41½	5.50 @5.75	5.30 @5.60	17.00 @18.00
22	4.7650	48⅞	19.45 @19.75	41¼	5.35 @5.75	5.20 @5.60	17.00 @18.00
23	4.7638	48⅛	19.45 @19.75	41	5.35 @5.75	5.20 @5.60	16.00 @18.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
17	23 5/16	83¼	84¼	96	20.86	168	165¾	25⅝	5.57	110	24.89
18	23⅜	82	83	95½	20.74	168½	166	26⅛	5.68	110	24.89
19	23⅜	.....	.....	.....	.....	.....	....	.....	.....	....	....
21	23 5/16	83	84⅛	95½	20.74	170½	168	24 13/16	5.39	102½	22.27
22	23¼	82¾	84	95½	20.74	168¾	166½	24⅝	5.35	90	19.55
23	23⅛	82	83	95	20.63	168	165¾	23 11/16	5.15	92½	20.10

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

E. H. Gary, president of the United States Steel Corporation, announced June 17 that the corporation had decided to build a zinc-smelting plant near Pittsburgh. Judge Gary said: "We have decided to build near Pittsburgh, probably at Donora, a new plant for the manufacture of zinc and its byproducts, including sulphuric acid, at a cost of from $2,500,000 to $3,000,000. We have for some years been considering the building of such a plant in order to supply material for our own use." The magnitude of the estimate indicates smelting works of large capacity.

The U. S. Smelting, Refining & Mining Co. has bought the smeltery of the Laharpe Spelter Co. at Altoona, Kan., and has taken over the entire stock of ore and all contract obligations. Its spelter will be sold through the regular channels of the U. S. organization. The smelter has entered into a contract with the Butte & Superior company to take 800 tons monthly of its ore on a toll basis, beginning in August and continuing presumably to the end of this year.

George E. Nicholson is building a four-block plant near Tulsa, Okla. It is expected that this will be in operation about Oct. 1.

The American Zinc, Lead & Smelting Co. is adding five blocks of furnaces to its Caney plant by contract with the Butte & Superior company.

It is reported that the old smeltery at Nevada, Mo., is to be repaired and reopened.

Joplin reports that another company of ore producers is to build a new smelting plant at Pittsburg, Kansas.

The report that the American Metal Co. has taken over the plant of J. B. Kirk at Iola, Kan., is denied. The Kirk plant is one of the works of the old Lanyon Zinc Co.

Zinc dust is quoted at 27@28c. per lb.

Notwithstanding the decline in prime Western spelter, high-grade metal maintains its price. Sales of spelter guaranteed 99.75% Zn were made this week at 34c. per lb.

Other Metals

NEW YORK—June 23

Aluminum is still strong. The chief domestic producer will quote only to regular customers, and the current market depends on imported metal, which is only in moderate supply. Quotations are firmer, at 31@33c. per lb. for No. 1 ingots, New York.

Antimony is strong on limited sales; supplies are limited and buying confined to absolute needs. Ordinary brands—chiefly Chinese and Japanese—are 37@40c. per lb., according to size of order. Cookson's is held at 46@50c. per lb., according to terms and deliveries.

A recent quotation in London is £125 per ton—equal to 27.16c. per lb.—for English regulus.

Nickel is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.

Quicksilver holds its price on a market which is active on a rather limited scale. New York quotation for large lots is unchanged at $95 per flask of 75 lb. for large lots; for smaller orders $95@100 per flask. San Francisco price advanced from $85@90 to $95. Demand is reported brisk at the high price. London price is £14 15s. per flask; same figures quoted from second hands.

Gold, Silver and Platinum

Silver—The market, after holding steady for some time around 23 1/16d., has finally given way and declined to 23 1/8 d. in London. The market is dull and stagnant, with limited demand; offerings continue light or price would fall further. China is not buying and demand from India is only moderate. The Continental demand is also slight.

Platinum has been slightly more active but is still quiet. Prices are not materially changed, dealers asking $37@39 per oz. for refined platinum and $41@44 for hard metal.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—June 19

The base price paid this week for 60% zinc ore was $115@130 per ton; lower at the the end of the week. No sales of lead ore here reported.

SHIPMENTS WEEK ENDED JUNE 19

	Zinc Ore Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,663,660	82,000	507,400
Year	88,676,630	3,122,090	12,456,870

Shipped during week to separating plants, 5,506,100 lb. zinc ore.

JOPLIN, MO.—June 19

Blende, high price $131; assay base per ton of 60% zinc, premium ore, $128; medium grades $115@100; lower grades $90@70; calamine, base 40% zinc, $80@60; average, all grades zinc, $112.64. Lead, high price $77; base $72@75 per ton 80% metal content; average, all grades lead, $70.40 per ton.

SHIPMENTS WEEK ENDED JUNE 19

	Blende	Calamine	Lead	Values
Totals this week	11,607,580	700,840	1,619,320	$756,470
Totals this year	277,232,240	24,426,480	40,758,870	11,118,220

Blende value, the week, $670,490; 25 weeks, $9,570,350.
Calamine value, the week, $22,710; 25 weeks, $499,180.
Lead value, the week, $56,940; 25 weeks, $1,042,360.

Iron Trade Review

NEW YORK—June 19

The activity in the iron and steel trades continues to increase. The gain is not wholly in export trade, domestic orders showing gains, especially in railroad work.

The foreign orders include, besides shells and other war munitions, a number of locomotives and cars and a considerable tonnage of rails. In domestic orders the mills are getting in addition to railroad work a good many orders for plates and shapes for shipbuilding, and more are expected before long.

PITTSBURGH—June 22

Bookings by the steel interests since the first of the month have been somewhat in excess of shipments, although shipments are heavier than a month ago. Production is at about 80% of capacity, and the Pittsburgh and Valley mills are exceeding this average, the Carnegie Steel Co., indeed, having almost its entire capacity engaged.

The more recent increase in demand is attributable to still heavier demand for steel for direct export and for the manufacture of war munitions. The Russian and French governments have been heavy buyers of railway material. The Steel Corporation has been a heavy seller of war material and it is understood that its attitude in this matter has changed since the government's dissolution suit was decided.

Predictions are now general in the steel trade that the mills will be operating at capacity shortly, probably by some time in August. While appearances in the steel trade proper are altogether favorable, sight should not be lost of the fact that coke, scrap and pig iron are all in better supply than demand and that prices of these commodities are not one whit higher than in January. The steel trade may become really prosperous, but the iron trade as a whole can hardly be considered prosperous until pig iron makes a better showing.

COKE

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie in May was 5,238,504 tons, being 90,838 tons more than in May, 1914. For the five months ended May 31 the totals were, in short tons:

	1914	1915	Changes
Anthracite	4,718,167	4,580,414	D. 137,753
Bituminous	18,288,294	16,597,074	D. 1,691,220
Coke	4,407,219	4,008,443	D. 398,776
Total	27,413,680	25,185,931	D. 2,227,749

The total decrease this year was 8.1%. The tonnage has taken an upward turn, as shown by the increase in the month of May.

Chemicals

NEW YORK—June 23

The general market has been a little more active and there seems to be a steadier tendency apparent.

Arsenic—The market remains quiet and unchanged, with only a moderate business. Quotations are about $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is steady and prices somewhat stronger. The current quotation is $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller orders.

Nitrate of Soda—The market continues strong and steady, although transactions are rather variable in quantity. Quotations are 2.20c. per lb. for spot and all positions this year.

The Nitrate Propaganda Office, of Chile, reports the production of nitrate for April and the four months from Jan. 1 to Apr. 30, in short tons:

	1914	1915	Changes
April	283,390	100,543	D. 182,847
Four months	1,041,139	391,193	D. 649,946

Consumption in the United States for the four months is estimated at 216,058 tons in 1914, and 230,432 tons in 1915; an increase of 14,374 tons this year.

Assessments

Company	Delinqe	Sale	Amt.
Advance, Ida., (post.)		July 1	$0.005
Belcher, Nev., (post.)	June 14	July 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	0.05
Blue Bell, Ida	July 5	Aug. 4	0.003
Blue Star, Ida	June 19	July 10	0.01
Carbonate, Ida	July 23		0.001
Cash Boy, Nev., (post.)		June 21	0.01
Challenge Con., Nev	July 12	Aug. 4	0.05
*Contact Copper, Mich		July 14	0.50
Contact Copper, Mich	May 15		0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Duluth, Ida	June 5	July 8	0.001
Glen Metal, Ida	May 31	July 1	0.002
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Houghton, Mich	May 25		1.00
Idora, Ida	June 3	July 2	0.005
Iron Mask, Ida	July 1	Aug. 10	0.002
Majestic-Idol, Nev	Dec. 15	July 20	0.005
Mayflower, Ida	June 15	July 17	0.005
Mineral Range, Utah	May 24		0.003
Monarch Pitts., Nev	June 14	July 14	0.01
Moonlight, Ida	June 5	July 8	0.005
Nabob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich	June 1		0.50
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	July 15		0.50
New Baltic, Mich	Jan. 15		0.50
New Yerrington Cop., Nev	July 9	July 27	0.01
North Bunker Hill, Ida	June 12	July 17	0.002
Old Veteran, Ida	July 5	July 31	0.002
Rainbow, Ida	July 7	Aug. 7	0.002
Revelator, Utah			0.01
Rhode Island, Ida	June 24	July 24	0.001
Royal, Ida	June 1	July 6	0.0015
Silver Mountain, Ida., (post.)		July 15	0.002
Silver Pick, Nev	June 5	July 12	0.01
Sunset Dev., Ida	June 30	July 24	0.0025
Umatilla Tonopah, Nev	July 12	Aug. 16	0.01
Union, Nev	June 18	July 9	0.05
Virginia, Ida., (post.)		June 29	0.02
West Tonopah Con., Nev	July 10	Aug. 10	0.01
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

*This assessment was levied and payable Apr. 27, '14.

Stock Quotations

Sales at auction cluded: New York, 40 shares Metallurgical Securities Co. preferred, 40; 20 shares Metallurgical Securities common, $1 per share. Philadelphia, 5000 San Juan Gold Min. Co., $3 lot; 2000 Cons. Gray Eagle Mines, $1 lot; 1000 U. S. Min. & Sm., $1 lot; 480 United Mining com., $1 lot; 60 United Mining pfd., $1 lot; 300 Tortilita Copper, par $1, 25c. per share.

COLO. SPRINGS June 18		SALT LAKE June 21	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.03¾	Beck Tunnel	.05½
Cripple Cr'k Con	.01	Black Jack	.09
C. K. & N.	.04	Colorado Mining	.10
Doctor Jack Pot	.10½	Crown Point	.01¼
Elkton Con.	.39½	Daly-Judge	7.10
El Paso	.90	Gold Chain	.11
Findlay	.03	Grand Central	.57
Gold Dollar	.02	Iron Blossom	.88
Gold Sovereign	.04½	Little Bell	.10
Golden Cycle	1.75	Lower Mammoth	.04½
Isabella	.18½	Mason Valley	2.50
Jack Pot	.06½	May Day	.20½
Jennie Sample	.02	Opohongo	.00¾
Jerry Johnson	.04½	Prince Con	.58
Lexington	‡.008	Seven Troughs	.01¼
Mary McKinney	.35	Silver King Coal'n	3.15
Pharmacist	.01	Silver King Con	2.17
Portland	1.40	Sioux Con.	.03½
Raven B. H.	.02	Uncle Sam	.05½
Vindicator	1.65	Yankee	.03¾

TORONTO June 21			
Bailey	.02	Dome Exten	.12
Coniagas	.05	Foley O'Brien	.30
Peterson Lake	.22	Hollinger	25.75
Right of Way	.03	Imperial	‡.05½
Seneca Superior	⅜	Jupiter	.10
Silver Queen	.01	McIntyre	.40
T. & Hudson Bay	‡18.50	Pearl Lake	.01
Timiskaming	.34	Porcu. Crown	.75
Wettlaufer-Lor	.03½	Preston E. D.	.02
Big Dome	17.12½	Rea	.10

SAN FRANCISCO June 21			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.04	Belmont	4.15
Andes	.05	Jim Butler	.90
Belcher	.20	Lone Star	.06
Best & Belcher	.06	MacNamara	.03
Caledonia	.18	Midway	.16
Challenge Con	‡.06	Mont.-Tonopah	.27
Confidence	.05	North Star	.15
Con. Virginia	.06	Rescue Eula	.09
Gould & Curry	.03	West End Con	.83
Hale & Norcross	.03	Atlanta	.31
Julia	‡.02	Booth	.52
Mexican	.34	C.O.D. Con	.04
Occidental	.79	Comb. Frac	.09
Ophir	.11	Jumbo Extension	1.55
Overman	.05	Pitts.-Silver Peak	.12
Potosi	‡.03	Round Mountain	.42
Savage	.03	Sandstorm Kendall	.09
Sierra Nevada	.04	Silver Pick	.11
Union Con.	.17	Central Eureka	‡.16
Yellow Jacket	.30	So. Eureka	‡1.50

N. Y. EXCH. June 21	
Name of Comp.	Clg.
Amalgamated	76½
Am.Sm.&Ref.,com	82
Am. Sm. & Ref., pf.	114½
Am. Sm. Sec., pf. B.	‡80
Anaconda	36⅜
Batopilas Min	1⅜
Bethlehem Steel	171½
Bethlehem Steel, pf.	115
Chino	46
Colo. Fuel & Iron	33
Federal M. & S., pf.	50
Great Nor., ore., ctf.	57½
Guggen. Exp.	64½
Homestake	119
Inspiration Con	32
Mex. Petroleum	76½
Miami Copper	26
Nat'l Lead, com	64⅜
National Lead, pf	110
Nev. Consol	15½
Ontario Min	3½
Quicksilver, pf.	4½
Ray Con.	24½
Republic I&S, com.	30
Republic I&S, pf.	87⅜
SlossSheff'd, com	36½
Tennessee Copper	38½
Utah Copper	68
U. S. Steel, com	61½
U. S. Steel, pf.	109½

N. Y. CURB June 21	
Alask'a Juneau, w.i.	13½
Alta Con.	.70
Beaver Con.	.32
Big Four	‡.05
Blue Bell	.03
Braden Copper	7⅜
Buffalo Mines	.50
Can. Cop. Corpn.	‡1 1/16
Can. G. & S.	.03
Caribou	‡.50
Cashboy	.07
Chambers Ferland	.16
Chile Cop.	20½
Con. Ariz. Sm.	13/16
Con. Coppermines	‡2½
Con. Nev.-Utah	⅛
Davis-Daly	‡1½
Diam'field-Daisy	.07
Dia. Black B.	.03
Florence	.53
Goldfield Con.	1 9/16
Goldfield Merger	.23
Greene Cananea	40½
Kennicott Cop.	29½
Kerr Lake	4 7/16
La Rose	.56½
McKinley-Dar-Sa.	.28
Majestic	.84
Mines of Am.	2½
Nevada Hills	.24
New Utah Bingham	3½
Nipissing Mines	5.87½
Ohio Copper	.22
Oro	.09½
South Utah	‡½
Stand'd Oil of N.J.	401
Standard S. L.	1½
Stewart	2 1/16
Tonopah	7⅛
Tonopah Ex.	3
Tonopah Merger	.41
Tribullion	5/16
Tularosa	5/16
Yukon Gold	2⅛

LONDON June 10			
Alaska Tre'dwell	£7	3s	9d
Cam & Motor	0	14	9
Camp Bird	0	5	6
El Oro	0	7	3
Esperanza	0	7	3
Mexico Mines	3	12	6
Oroville	0	14	0
Santa Gert'dis	0	7	6
Tomboy	1	5	0
Tough Oakes	0	8	6

BOSTON EXCH June 21	
Name of Comp.	Clg.
Adventure	2½
Ahmeek	390
Alaska Gold M.	37⅛
Algomah	3
Allouez	56½
Am. Zinc	51⅛
Ariz. Com., ctfs.	7¼
Bonanza	.35
Butte-Ballaklava	3½
Butte & Superior	69½
Calumet & Ariz.	66⅜
Calumet & Hecla	585
Centennial	19
Cliff	‡1½
Copper Range	55½
Daly West	3½
East Butte	13
Franklin	10⅜
Granby	88½
Hancock	19½
Hedley	28
Helvetia	.50
Indiana	6½
Island Cr'k, com	47½
Island Cr'k, pfd.	89½
Isle Royale	28
Keweenaw	2½
Lake	14½
La Salle	6½
Mass.	13½
Mayflower	4½
Michigan	2½
Mohawk	78
New Arcadian	12
North Butte	33½
North Lake	2½
Ojibway	2
Old Colony	4½
Old Dominion	‡56½
Osceola	88
Quincy	87
Santa Fe	3
Shannon	8⅛
Shattuck-Ariz.	28
Superior	29½
Superior & Bost.	3⅛
Tamarack	37
Trinity	5
Tuolumne	55
U. S. Smelting	45⅛
U. S. Smelt'g, pf.	47
Utah Apex	4⅛
Utah Con.	14½
Victoria	3
Winona	4½
Wolverine	62
Wyandot	1

BOSTON CURB June 21	
Name of Comp.	Bid.
Alvarado	‡.70
Bingham Mines	.09½
Boston Ely	.28
Butte & Lon'n Dev.	.24
Calaveras	1⅞
Calumet-Corbin	.05
Chief Con.	.98
Corbin	.85
Cortez	.50
Crown Reserve	.70
Eagle & Blue Bell	1 1/16
First Nat. Cop.	2⅛
Houghton Copper	4½
Iron Cap Cop., pf.	‡6½
Majestic	.84
Mexican Metals	.18
Nevada-Douglas	.45
New Baltic	3½
Oneco	1⅞
Raven Copper	.07
Smokey Dev.	.30
So. Lake	6⅜
Tonopah Victor	‡.32
Trethewey	.10
United Verde Ext.	4 5/16

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.430	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471		27.199	25.948	
July	58.721	54.678		27.074	25.219	
August	59.293	54.344		27.335	25.979	
September	60.640	53.290		27.986	24.260	
October	60.793	50.654		28.083	23.199	
November	58.995	49.082		27.263	22.703	
December	57.760	49.375		26.720	22.900	
Year	59.791	54.811		27.576	25.314	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603		61.336		66.274	
July	13.223		60.540		64.955	
August	*		‡		‡	
September	*		‡		‡	
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577		138.321	
July	31.707		142.517	
August	*		‡	
September	32.675		‡	
October	30.284		‡	
November	33.304		159.391	
December	33.601		147.102	
Av. year	34.301			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900		3.810		19.411	
July	3.891		3.738		19.051	
August	3.875		3.715		‡	
September	3.828		3.658		‡	
October	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.737			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000		4.850		21.345	
July	4.920		4.770		21.568	
August	5.568		5.418		‡	
September	5.380		5.230		‡	
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.061			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15 07	14.55	13 .94	13.45	14.10	13.95
April	14.90	14.55	13 .9.	13.45	14.13	13.95
May	4.90	14.61	13 .90	13.60	14.27	13.83
June	14.90		13 .90		13.96	
July	14.90		13.90		13.90	
August	14.90		13.90		14.08	
September	14.90		13.90		14.03	
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	

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NUMBER OF COPIES PRINTED THIS ISSUE, 9,500

None sent free regularly, no returns from news companies, no back numbers.

The Subscribers' Forum

Conducted by the Business Manager of The Journal

The Other Fellow

IN each of the last five issues of the Journal, the Buyers Cyclopedia has been printed in English.

And in this form the readers of the Journal using the English language have become familiar with its position in the paper, its purpose, and its rapidly increasing usefulness

The July 3 issue will contain an innovation — interesting, useful, valuable.

The Buyers Cyclopedia, in that issue, will be printed in Spanish as well as English. This will make the new department still more useful to the Journal's Spanish-speaking readers.

But to increase still further the scope of the Cyclopedia, the July 3 issue will have an increased circulation in all countries where Spanish is spoken. This will give the many who buy mining supplies but who do not use English, a Buyers Cyclopedia in their own language.

The Spanish number marks the first of the foreign editions, one of which will be published each month bound together with the English.

This means practically that within a year, the Buyers' Cyclopedia will have reached the men who buy equipment, supplies, etc., for metal mines, mills and smelters, in every country—and *in the language of those countries*—not alone in English.

It will cover the world in a double-barrelled manner.

The mineral resources of the Spanish-speaking countries on this hemisphere are proverbial. They are also appreciated by American and other outside operators.

What is every bit as important but perhaps not so widely appreciated is the awakening of these countries to their own mineral possibilities.

The Spanish Cyclopedia will be used by *these* men.

In China, India, Russia—the same awakening is going on.

And in those countries and those languages and many others—

It will also serve.

Are you represented ?

50% Increase in Drilling Capacity With A Third Less Air—A Third Less Labor

That is the showing we guarantee the "New Cleveland" Type S Stoper to make against any other drill. The showing to be made in your mine—made before you pay one cent for the stoper.

This name plate on your hammer drills is an absolute guarantee of all that is best.

This name plate on your hammer drills guarantees all that is best.

We are ready to ship you a machine for a free trial and if it doesn't live up to our guarantee, viz: a saving of 50 per cent. in drilling costs and prove itself the best drill you ever saw, send it back.

If we prove our claims in a trial in your mine think of the saving you can make on production costs. If we don't prove our claims you cannot lose a cent. A fair clean-cut business proposition you must admit. Then sign and send the coupon now.

The Cleveland Rock Drill Co.

6410 Hawthorne Avenue

Cleveland, Ohio

Canadian trade supplied by
The Cleveland Pneumatic Tool Co., of Canada, Limited,
80 Duchess St., Toronto, Ont.

Sign This Coupon—Tear it Off—Mail Now.

Mail Bulletin No. 35 and trial order blank to.....

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Address.....

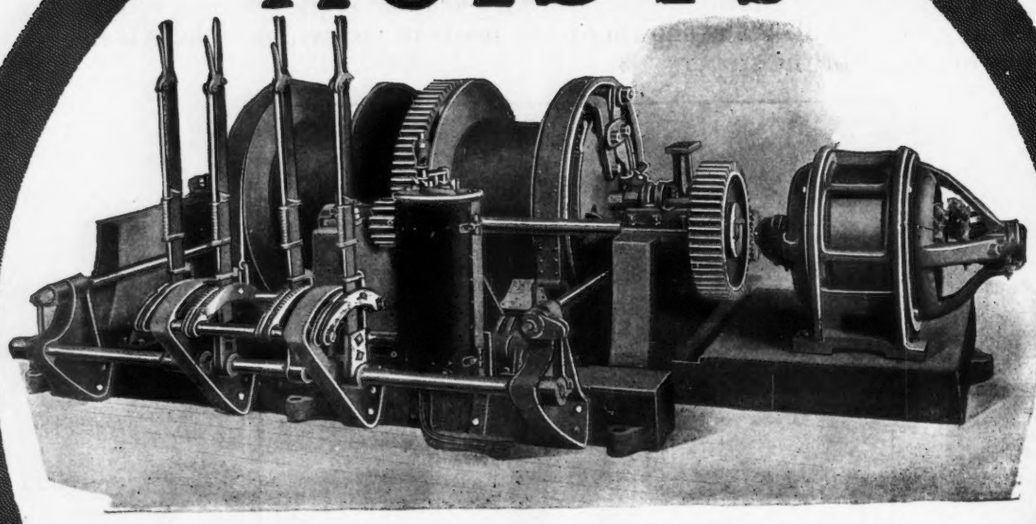
Position.....

Name of Mine.....

City.....

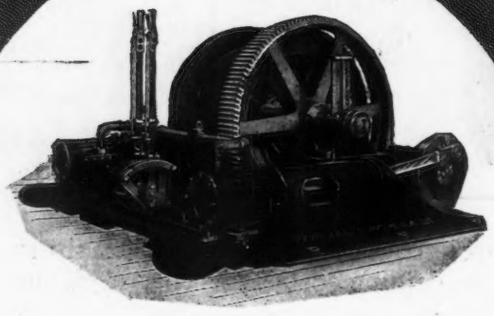
State.....

HOISTs



DOUBLE DRUM ELECTRIC HOIST—BAND BRAKE

ELECTRIC
or
STEAM



SINGLE DRUM STEAM HOIST
BAND BRAKE

FOR
EVERY PURPOSE

(OUR CATALOG IS FREE)

THE HENDRIE & BOLTHOFF MFG. & SUPPLY CO.

DENVER. COLORADO. U. S. A.

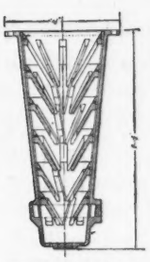
THE PIONEER MINING MACHINERY HOUSE OF THE WEST.

THE HENDRIE & BOLTHOFF MFG & SUPPLY CO.

DENVER, COLO.

STEAM ELECTRICAL AND HYDRAULIC ENGINEERING ~ MINE AND SMELTER SUPPLIES.

DEISTER MACHINE COMPANY'S
SIMPLEX CONCENTRATORS
and
Cone Baffle Classifiers
have justly attained the position of
LEADERSHIP
in the art of Ore Concentration



CLASSIFIER
Weight 132
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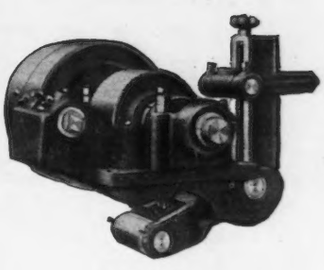
Patented



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NOTE: We build Single and Double-Deck Machines.

Write for Catalogue Now

Repeat orders for 306 Simplex Sand Tables
" " " 91 " Slime Tables
" " " 603 Cone Baffle Classifiers
have been received by us during the last 15 months.

The Miami Copper Co. of Miami, Arizona, has recently given us the orders for 42 Double Deck Tables and 83 Classifiers.

The Inspiration Con. Copper Co.'s new plant at Miami, Arizona, is being equipped with 234 Double Deck Simplex Tables and 400 of our Classifiers.

DEISTER MACHINE COMPANY

INCORPORATED JULY, 1912

Home Office and Factory:—1933-2003 East Wayne Street, FORT WAYNE, IND., U. S. A.
London Office:— 562 Salisbury House LONDON WALL, E. C.

AGENTS

WILLIAM L. REEDER	410 Consolidated Building	JOHANNESBURG, SO. AFRICA
TAKATA & COMPANY	2 Yeiraku-cho, Nichome, Kojimachi-ku	TOKYO, JAPAN

Want to Operate Your Hoist by Water Power?

WELLMAN-SEAVER-MORGAN

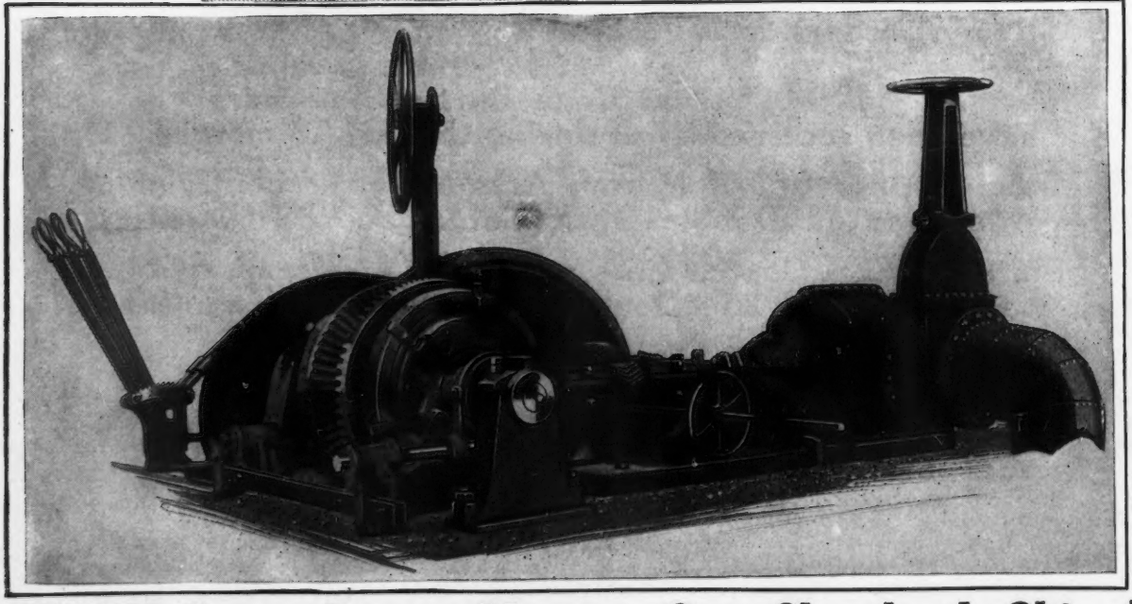
If so, you will be interested in this **Hoist** (shown **below**) **driven by Hydraulic Turbine** (sectionalized for mule-back transportation when desired). It makes a very compact, efficient unit.

Particulars

With drum 60″ diameter by 66″ face, it handles in balance skips weighing 4500 lbs. each, with 8000 lbs. of ore, from a depth of 500 ft. It is driven by a 9″ bronze turbine at 1600 RPM. running continuously and controlled by a governor, the drum being reversed at will by the ingenious arrangement of bevel gears and friction clutches shown in illustration. The entire equipment is mounted on a steel structural framework or bed plate imbedded in the concrete foundation. The drum and the driving gears are likewise of steel to insure lightness with the greatest amount of strength. Where desired, this hoist is sectionalized to 250 lbs. for muleback transportation into mountainous districts.

The hoist is so arranged that an electric motor can be substituted for the turbine on the same base at any time in the future if desired.

Send us details of your requirements.



One satisfied customer reports as follows:

"The hoist was tried out in December just as I was leaving the mine. and worked without a hitch. It has been running in service ever since and is reported by the mine management as being perfcet. It certainly is a handsome piece of machinery and we are grateful to you for the attention given to make it so."

We shall be glad to give the same painstaking care to YOUR hoist problem that we did in the above case.

The Wellman-Seaver-Morgan Co., Cleveland, Ohio, U.S.A.

New York, 50 Church Street **Denver, 611 Ideal Building**

The Sorting Column

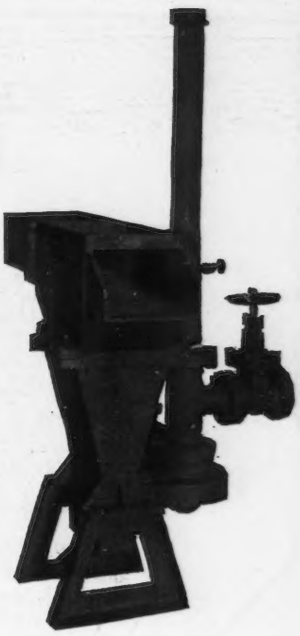
Many methods of determining whether ore contained gold or other metal have been advanced. Probably some of the most ancient, of which we have record, are the following which Agricola describes in his "De Re Metalicca:"

> "We determine in the following way, before it is melted in the muffle furnace, whether pyrites contain gold in it or not; if, after being three times roasted and three times quenched in sharp vinegar it has not broken nor changed its color, there is gold in it. The vinegar by which it is quenched should be mixed with salt that is put in it, and frequently stirred and dissolved for three days. Nor is pyrites devoid of gold, when after being roasted and then rubbed on the touchstone, it colors the touchstone in the same way that it colored it when rubbed in its crude state. Nor is gold lacking in that, when concentrates from washing, when heated in the fire, easily melt, giving forth little smell and remaining bright; such concentrates are heated in the fire in a hollowed piece of charcoal covered over with another charcoal."

Next week the "Sorting Column" will contain Agricola's account of the saving of sulphur and bitumen. It tells of the 1550 method. Be sure to read the "Sorting Column" next week.

DENVER ENGINEERING WORKS

An Automatic Riffle with a Continuous Discharge of Concentrate



Richards Pulsator Riffle for Gold Dredger

The saving qualities are as fine as those of the Hungarian riffle, on which principle it is based. But the application of an intermittent pulsating current of water gives these advantages:

Pulsating gravel in pockets between the angle irons is in constant agitation. It cannot pack—requires no clean-up. The finest grains of gold settle rapidly through this gravel bed and pass into the hutch.

Riffle needs but one adjustment—amount of water supplied to it. Water pressure required, not over 7 pounds. It means higher recoveries. Have you our Bulletin?

THE DENVER ENGINEERING WORKS CO.
Denver Colo.

Hard Knocks — Rough Use — Long Wear
That's What the

BALDWIN
THE MINER'S LIGHTING BUG

DRAWN STEEL LAMPS
Are Made for

The water tank and carbide containers are seamless drawn steel shells, heavily tinned.

Drawn Steel is more durable than cast metal, as a hard fall or heavy blow may fracture cast metal, whereas it will only dent Drawn Steel.

Only two soldered seams in the entire construction, practically no chance for leaks.

Screw threads just again as heavy as those found in any other lamp. Hooks welded on by the oxy-acetylene process (not soldered)—you can't tear them loose.

Easiest Lamps to Operate and Care For

Water-feed automatically regulated. Never any blowing at the burner; never any carbide wasted.

All the attention this lamp requires is that the raking wire be rotated once or twice during the charge—this takes possibly five seconds.

Should the feed corrode, take out the raking wire and scrape with a knife blade or rub with an emery cloth—this takes about thirty seconds, and you only have to do it about once a month.

TO CHANGE THE BURNER—give the reflector a turn or two, this pushes off the old burner, then slip on a new burner and light—this takes about ten seconds—no tools needed and no grease or white-lead necessary to make a gas-tight joint—you can change a burner as handily in the dark as out in the open.

TO CHANGE THE REFECTOR—simply unscrew the old one and screw on the new. When the reflector is in place, it is as solid and rigid as though a part of the lamp. To make it bump-proof, we reinforce it at the back with a steel shell.

All lamps equipped with sparker lighters.

No. 50—List Price $2.50
No. 53—List Price $2.75

No.	Burns on One Charge	Weight	Height
50	6 hrs.	14 oz.	5½"
53	12 hrs.	15½ oz.	6"

No. 52—List Price $2.60
No. 55—List Price $2.85

No.	Burns on One Charge	Weight	Height
52	6 hrs.	14½ oz.	5½"
55	12 hrs.	16 oz.	6"

John Simmons Co.
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The Wedge Mechanical Furnace

Patented

High Efficiency Furnace Working Days

Wedge Roasters are heavily constructed of best material and workmanship obtainable, and are also constructed so that all current repairs can be made without shutting down and cooling off the furnace.

This eliminates lost working days, also the necessity for spare furnaces, and reduces operating costs incident to the expense of shutting down and starting a furnace, plus the saving of lost tonnage incident to long shutdowns.

Write us in detail, giving analysis of ore, concentrates, mixture or material to be roasted, its characteristics and physical condition, number of tons to be treated per twenty-four hours, results you desire in the calcine, and any other data which will enable us to render you careful and intelligent service.

Wedge Mechanical Furnace Company

115 Chestnut St., Philadelphia

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Just Published

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By **C. S. Rindsfoos, C. E.**
President of the U. S. Purchasing Corporation, Formerly Secretary-Treasurer Foundation Co. 165 *pages*, 6*x*9, $2.00 (8/4) *net, postpaid.*

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It covers completely and in a practical manner the important features of the subject. The principles that underlie successful purchasing are brought out, and illustrated by examples from actual practice.

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III. How to Obtain Prompt Delivery.
IV. Making the Purchase Conform to Fixed Policy.
V. How to Obtain Favorable Terms.
VI. Personal Characteristics and Qualifications.
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VIII. Some of the Real Aspects of Purchasing.
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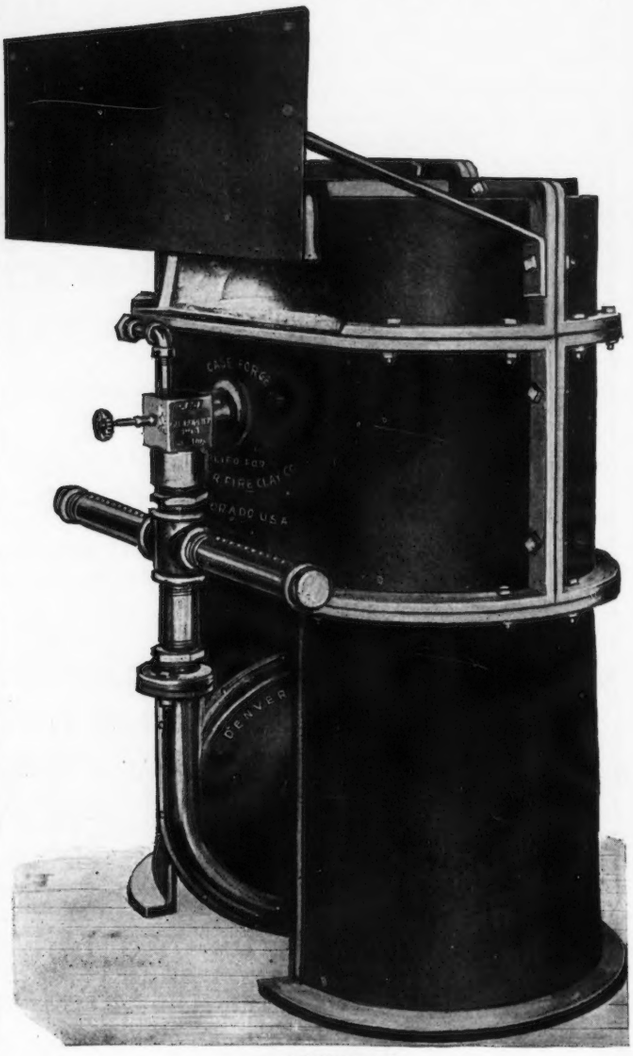
Note—If not a subscriber to The Engineering and Mining Journal, or a member of the A. I. M. E., give business reference in margin.

Heat the Steel, but— Don't Burn It.



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Oil Burning Low Pressure Forge

The fuel saving is 20 to 40%.
The steel saving is 10%.
You see the steel while it heats; therefore, no burning—This Forge is fast, will keep two Machine Sharpeners going.

Our latest furnace catalog gives other valuable pointers on the Case Forge.

Write for a copy. Today—

Denver Fire Clay Company

Denver Colo., U. S. A.

DENVER FIRE CLAY CO. PRODUCT

HAVE SURVIVAL VALUE

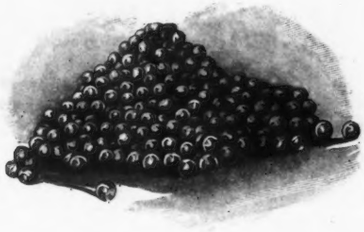
"60" Calyx Drill. Drilling for Magnesite.

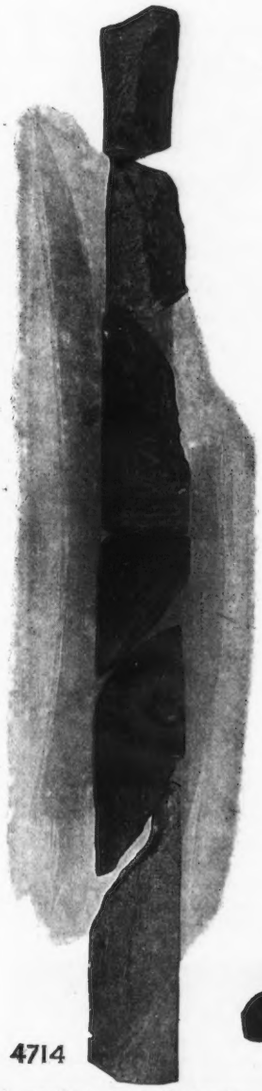
CALYX CORE DRILLS

A 5-inch core of soft coal

The most rapid, most economical, most reliable and simple machines for prospecting and testing, which can be had today.

Will penetrate any kind of material, giving an accurate double record.





4714

A perfect core through pockets and cavities

Uses inexpensive steel shot at the cutting end for hard materials and a steel cutter for soft.

The Calyx cuts cores from $1\frac{3}{8}$ to $18\frac{5}{8}$ inches in diameter and from all depths to 4000 feet.

Write for Bulletin No. 9101.

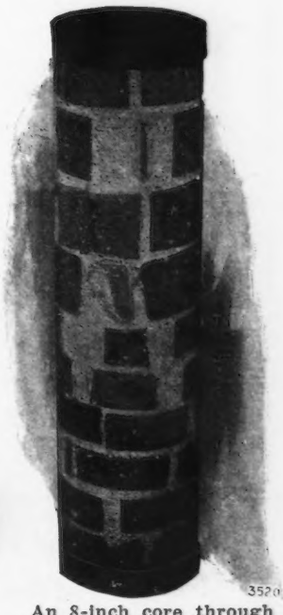
INGERSOLL-RAND COMPANY

New York Offices the World Over **London**

A-CD

4713

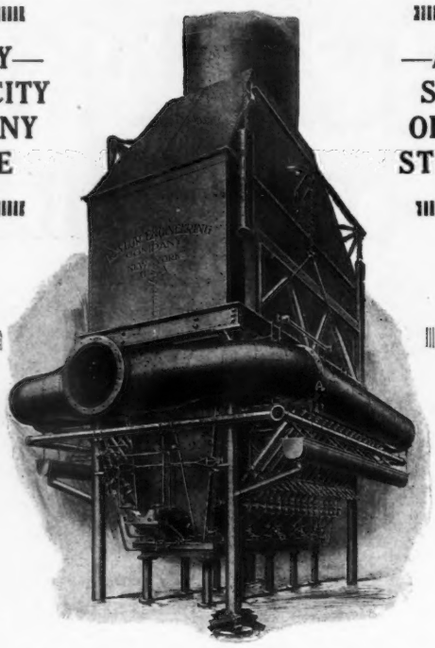
A 3⅛-inch Core of Seamy Limestone.



An 8-inch core through brick and two 2-inch steel plates

—ANY— CAPACITY ON ANY ORE

—ALL— SIZES OF ALL STYLES



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—OF THE—
TRAYLOR DESIGN
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We are today the leading builders of Copper Smelting Furnaces and Water Jackets because we have made a careful study of the different methods used, and are always in personal touch with the largest smelting companies in the world.

We have incorporated all the latest and modern improvements in our design of furnaces.

Many repeat orders which we secure every month are certain indications of the superior design, construction, and workmanship embodied throughout Traylor Smelting Machinery.

Send for Catalog V-1 describing Furnaces and Smelting Accessories.

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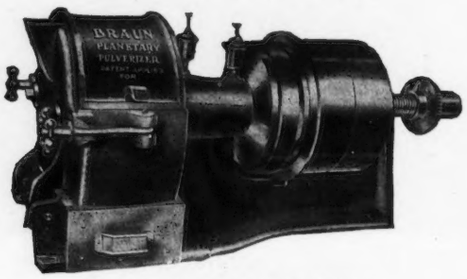
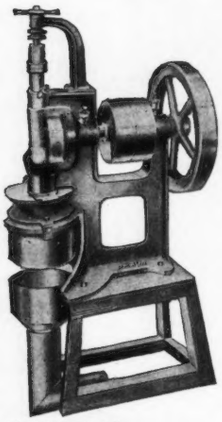
BRAUN
Laboratory Pulverizers
A Type for Every Purpose Simply Illustrated—

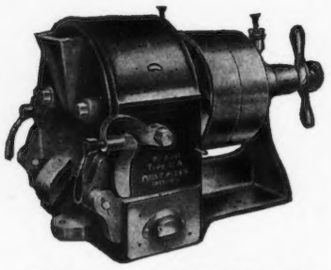
Fully described in Catalog No. 50 E. Your copy is ready. Write for it today.



PLANETARY PULVERIZER
with the *Planetary movement* for hard, soft and talcy ores.

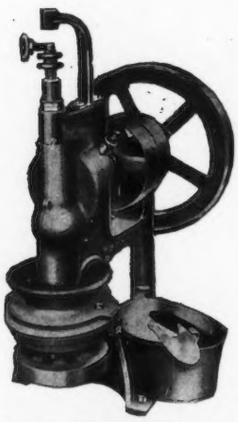


DUSTLESS PULVERIZER
A new type—dustless as the name implies.



TYPE "UA" PULVERIZER
The standard laboratory machine for ordinary material. The machine that "broke" the bucking board's back.

HAND GRINDER
For Ores, Coal, Coke. It produces results.



IRON ORE GRINDER
Fitted with *carbon steel plates* — especially adapted and successfully used in pulverizing Iron Ores.

BRAUN-KNECHT-HEIMANN-CO. San Francisco, U. S. A.
THE BRAUN CORPORATION Los Angeles, U. S. A.

Manufacturers of Laboratory Labor-Saving Machinery
Specialists in Laboratory Equipment and Testing Apparatus
Dealers in Laboratory Glassware and Chemicals

HAMMER YOUR DRILL BITS

Sullivan Sharpened Drill Bits
Cut Faster and Farther

Old Drillmen know that a bit, resharpened a few times on the anvil, will "hold its edge" better, cut faster and wear slower, than the same bit when first made up.

This illustrates our point when we say that *"hammering preserves the quality of your drill steel."*

Hammer-working is the oldest and best method of refining iron and steel. It gives the metal a finer, closer grain, greater strength and toughness, greater resistance to breakage and wear.

The Sullivan Sharpener

is a mechanical blacksmith, that forges drill bits entirely by hammering. One powerful air-hammer upsets the steel and forms the face of the bit, by rapid blows on a loose dolly. A second vertical air-hammer draws out the wings and corners in steel dies, one striking, the other holding the steel.

All this is done at one heat, in a minute or less, whether the bit is forged new from blank stock, or whether it is simply resharpened.

Great heat is not required—there is no danger of burning high carbon steel.

Other features of Sullivan all-hammer sharpeners that appeal to you are its quick-acting air vise, that holds the steel, of any length, in an unshakable grip while it is being upset; its compactness, 5 feet by $2\frac{1}{2}$; its solidity and strength—it weighs 4000 pounds; its power—each hammer is a $2\frac{5}{8}$-inch Sullivan Liteweight rock drill; its economy of air, its safety for the operator, and its convenient arrangement.

Bulletin 272.

SULLIVAN MACHINERY COMPANY
122 So. Michigan Avenue **Chicago, Ill.**

Birmingham Boston Butte Cobalt, Ont. Christiania Denver El Paso Joplin Juneau Knoxville London Montreal
Nelson New York Paris Pittsburgh San Francisco Salt Lake Seattle Sydney, N.S.W. Spokane St. Louis Vancouver

1860

COLORADO IRON WORKS COMPANY

ORE SMELTING EQUIPMENTS

ORE MILLING MACHINERY

1915

Our Field

PROFICIENCY requires concentration of effort. For many years we have concentrated all our efforts on the problems of recovering Gold, Silver, Copper and Lead from their ores.

Think what this means to you! Our restricted field enables us to be proficient in that field, to manufacture a complete line in that restricted field instead of a restricted line in a wider field. On the other hand, it places upon us the obligation to excel in that field.

Why do we limit our business to metals rather than processes? Because that is the only way in which we can do full justice to our customers, and we know that justice to them is essential to our continued success. Being wedded to no processes, we can give unprejudiced advice as to the treatment of any particular ore. There is no incentive for us to advise cyanidation where simple amalgamation will suffice, nor to recommend the smelting of an ore which should be treated by wet concentration.

Every ore treatment problem submitted to us is considered on its own merits without bias for or against any special method. We have no ax to grind.

Colorado Iron Works Co., Denver, Colorado, U.S.A.

AMERICAN BRIDGE COMPANY

HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS

Ore Dock and Approach for Northern Pacific Railway, Superior, Wis.

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Cleveland, Ohio . Rockefeller Building
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Export Representative:
United States Steel Products Co., 30 Church St., N. Y.

Roasts Low Grade Sulphur Ores Without Utilizing Extraneous Fuel

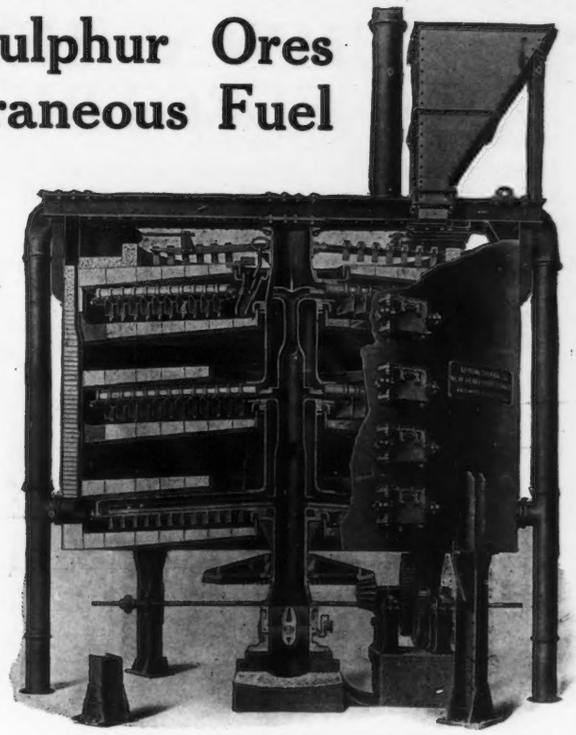
This is but one of the economical roasting possibilities of this furnace. Every hearth is a roasting hearth. The capacity is 40 per cent. greater without desulphurization.

The New Herreshoff Temperature Controlled and Air-Cooled Furnace for Roasting Ores

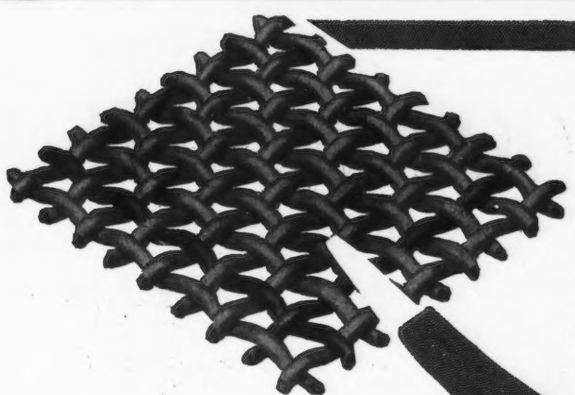
The temperature control has been so designed that these furnaces can be adapted to suit various conditions, making change of material to be handled of little importance.

Write for Catalogue

GENERAL CHEMICAL COMPANY
Herreshoff Furnace Department.
25 BROAD STREET, NEW YORK, N. Y.



PACIFIC FOUNDRY COMPANY
18th and Harrison Streets San Francisco California
Pacific Coast Agents



The Way to Economy
in your Screening Department
Lies Through
"Perfect" Double Crimped Wire Cloth

Its use means lower screening costs in every department. Built in every size that can possibly be required, from $\frac{7}{8}$-in. steel bars down through cement cloth not much coarser than a silk handkerchief, to 200-mesh brass cloth for chemicals, thus making it adaptable to all the screening operations of any kind in any mill.

THE **double-crimp means "no-slip"** — that's important.

As practically all wear is confined to the upper surfaces of the wire, it means that the mesh remains constant and an absolutely uniform product is delivered until the screen, is so worn, that it will no longer hold up under the load thrown on it.

A uniform product means faster, more economical operation of concentrators, slimers, etc., and a higher metal recovery.

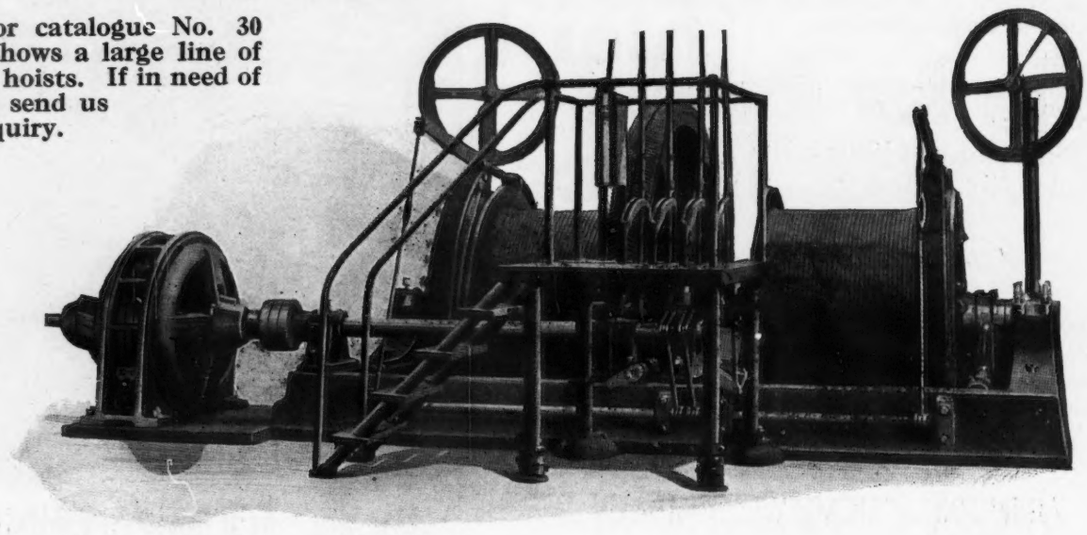
Want proof? Ask us for full details. Get our fine catalog—free.

LUDLOW-SAYLOR WIRE COMPANY
ST. LOUIS, MO.

"OTTUMWA HIGH EFFICIENCY ELECTRIC HOISTS"

"Ottumwa Hoists" are designed by expert Engineers to meet the special needs of the Mine at which they are to operate. This cut shows one of our double independent friction clutch drum electric hoists in operation at one of the large Iron Mines.

Write for catalogue No. 30 which shows a large line of modern hoists. If in need of a hoist, send us your inquiry.



Hoists from 15 to 75 H.P. in stock for prompt delivery.

Ottumwa Iron Works, Inc., Ottumwa, Iowa

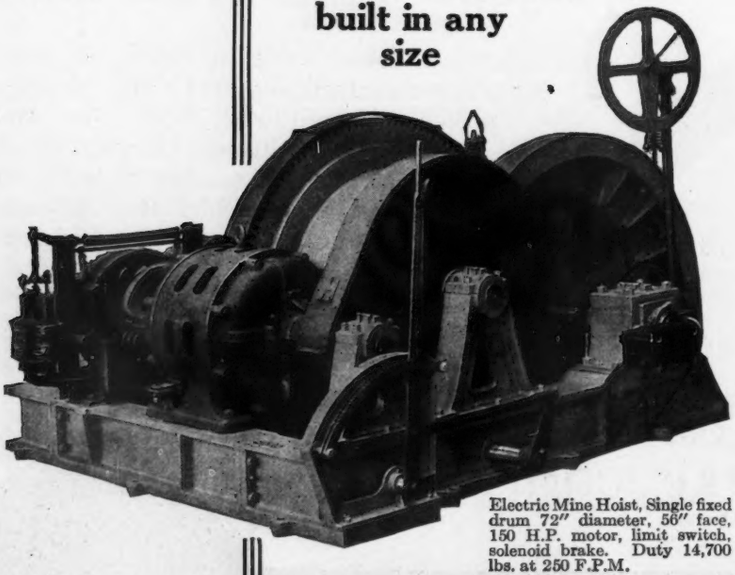
The Lidgerwood hoist of today embodies every improvement suggested by 41 years' experience

LIDGERWOOD HOISTS

Built to meet every mine service

ELECTRIC
built in any size

STEAM
Built up to 1000 H.P.



Electric Mine Hoist, Single fixed drum 72″ diameter, 56″ face, 150 H.P. motor, limit switch, solenoid brake. Duty 14,700 lbs. at 250 F.P.M.

Lidgerwood Mine Hoists are built with special regard to the fact that the continuous operation of the mine depends upon the hoist.

The design and workmanship of Lidgerwood Hoists is the best insurance against loss by breakdowns

More than 37,000 Steam and Electric Hoists built and used.

LIDGERWOOD MFG. CO.
96 Liberty St., New York
Philadelphia Pittsburgh Chicago Seattle

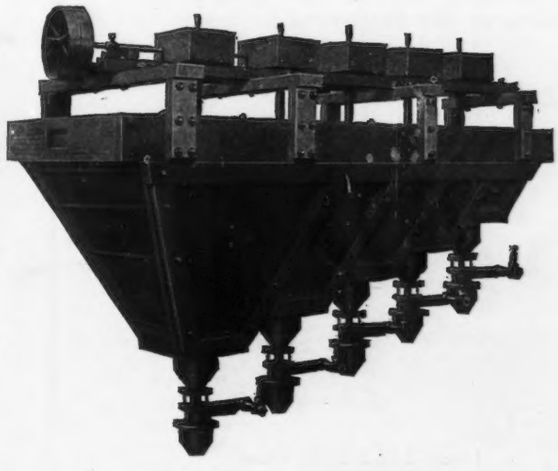
In Ore Dressing

the classifying of the particles by means of screens or hydraulic classifiers to facilitate the elimination of the gangue by concentration, is a necessary preparation.

Screening, or classification by size, is sufficient for the simple separation accomplished by jigging. However, concentration of fine material on tables and vanners is more complex and screen classification is found unsatisfactory. Hydraulic classification under free settling conditions is recognized as being more efficient in preparing ore for concentration on tables and vanners.

The development of a hydraulic classifier operating perfectly, has been the aim of millmen for many years. This result, however, was not achieved until the value of the hindered settling principle was recognized and adopted by Professor Richards in his Hindered Settling Classifier. (This classifier produces a feed best prepared for concentration on tables and vanners.)

We build two types of classifiers involving this principle which we can fully recommend.



The Richards Hindered Settling Classifier—the automatic type—is successful in the small as well as the largest plants.

The Richards-Janney Classifier—the mechanically operated type—is particularly adapted to large tonnage.

Allis-Chalmers Manufacturing Company

Mining Machinery Department, **Milwaukee, Wisconsin**

OFFICES IN ALL PRINCIPAL CITIES

YOU BUY SATISFACTION

when you purchase

The

Deister CONCENTRATOR Company's

Tables

Even in Far Off Bolivia we are accorded

Supremacy

Machacamarca, March 5th, 1915

The Deister Concentrator Company,
Fort Wayne, Indiana.

Dear Sirs:-

I am in receipt of your favour of Jan. 18, and in reply wish to inform you of the following:

****
****

It gives me pleasure to advise you that your tables are giving excellent service in our plants, and that the cost for repairs is absolutely trifling. Two #3 tables have been running now for 14 months, day and night, and the only repairs they have needed was a new spring after about 8 months running. This is a marvellous record for a table in a country, where the attendance to machinery is usually bad. I have used many different tables, --, --, --, --, --, and -- tables, but none of these will run for less than 5 times the cost of the Deisters.

Yours very truly,

Mill Mgr. for Cia Minera de Oruro

Improved No. 3 Deister Slimer

The

Deister CONCENTRATOR Company

Fort Wayne, Ind.

Manufacturers of Deister and Overstrom Tables

Denver Office
1718-1720 California St.

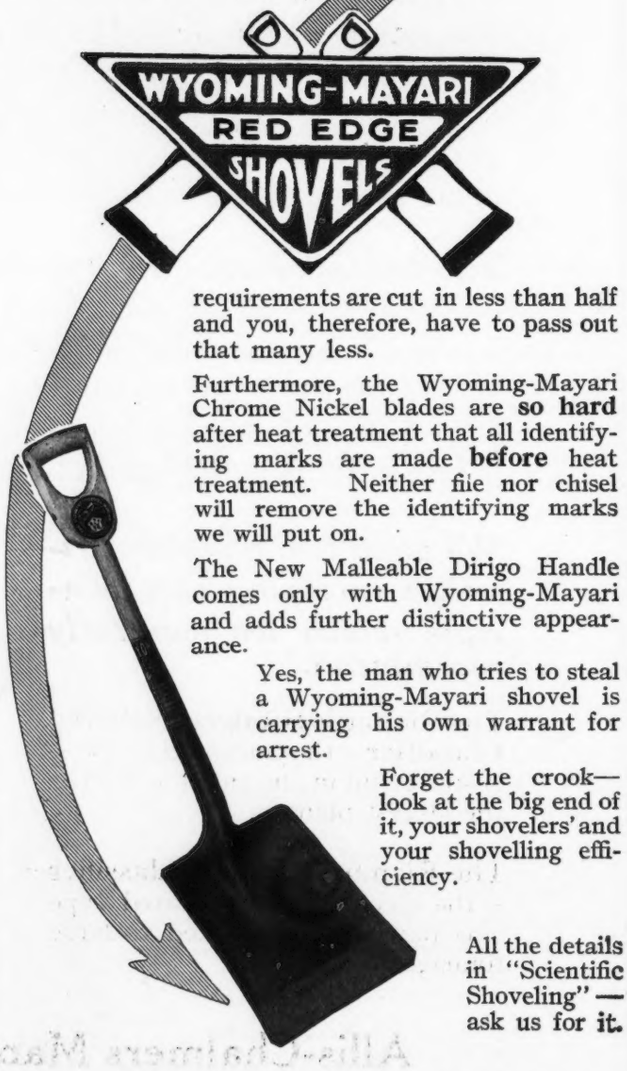
San Francisco Office
75 Fremont St.

Objection No. 1

ONE shovel user says: "Why buy a **good** shovel when so many are stolen, anyway?"

As well ask a banker to carry only counterfeit money because some of his employees have stolen in the past and may in the future.

But, if your bad conditions can't be changed you are simply supplying another argument in favor of Wyoming-Mayari Red Edge Shovels. With them your shovel



requirements are cut in less than half and you, therefore, have to pass out that many less.

Furthermore, the Wyoming-Mayari Chrome Nickel blades are **so hard** after heat treatment that all identifying marks are made **before** heat treatment. Neither file nor chisel will remove the identifying marks we will put on.

The New Malleable Dirigo Handle comes only with Wyoming-Mayari and adds further distinctive appearance.

Yes, the man who tries to steal a Wyoming-Mayari shovel is carrying his own warrant for arrest.

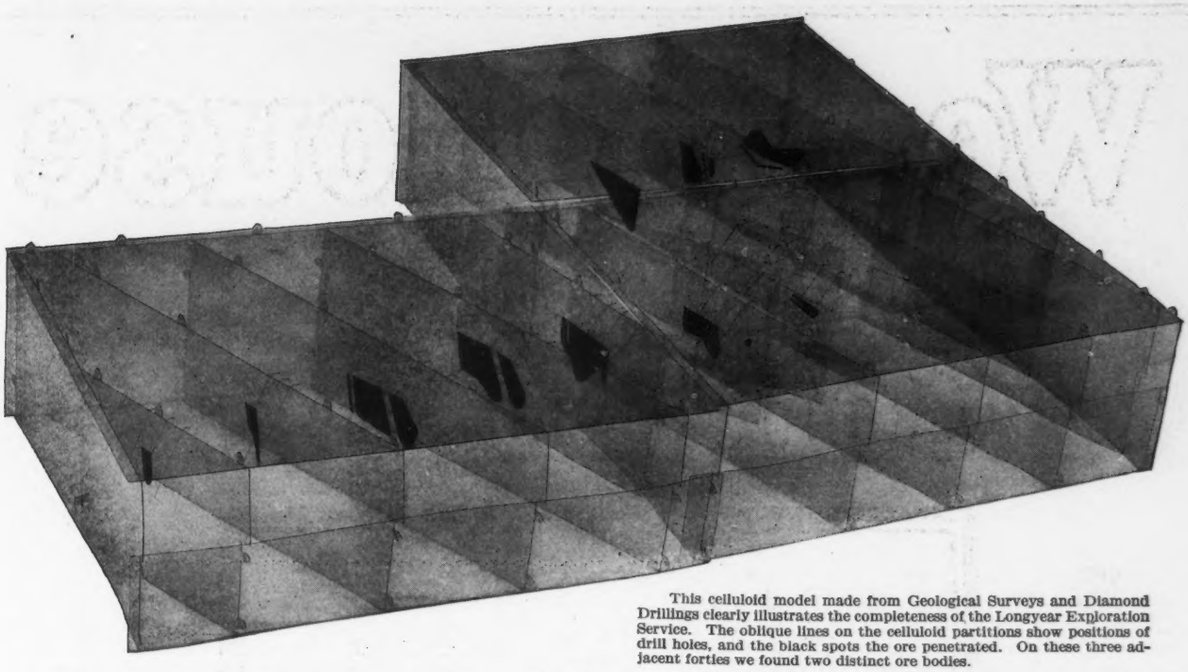
Forget the crook—look at the big end of it, your shovelers' and your shovelling efficiency.

All the details in "Scientific Shoveling"—ask us for **it.**

The Wyoming Shovel Works

Makers of Good Shovels for over 40 Years

Wyoming, Pa.



This celluloid model made from Geological Surveys and Diamond Drillings clearly illustrates the completeness of the Longyear Exploration Service. The oblique lines on the celluloid partitions show positions of drill holes, and the black spots the ore penetrated. On these three adjacent forties we found two distinct ore bodies.

Complete Exploration Service

During the past 25 years Mr. E. J. Longyear has associated with him a complete organization for exploring and estimating the possibilities of mining properties. This service, in part, or in full, is offered to large operators and small owners alike.

TO know the location and extent of any ore body before going to the expense of sinking shafts or tunneling is to save the greatest waste in mining and to reduce to a minimum the chances for failure.

Modern methods of exploration make it possible to prepare such estimates, step by step, and no large mining organization would think of taking the chances formerly taken without the guidance of such reports.

The E. J. Longyear Company through its different departments brings complete exploration service and advice to the assistance of all property owners at a price within the reach of the small proprietor as well as the large operator.

Geological Surveys

In most cases it is found impractical to start tunneling, to sink shafts, or even to begin diamond drilling, until geologists have made a thorough survey of the property and have mapped out the most economical locations for drill holes.

The services of this company's geological department may be purchased separately and are usually considered as insurance of thorough and at the same time economical diamond drilling.

The cost of such a survey is comparatively low.

Diamond Drilling on Contract

This organization has drilled over 3,000,000 feet of holes and has experienced crews of drillmen ready on a moment's notice to undertake drilling in any part of the world.

The Longyear method insures an accurate estimate of the quantity and quality of bodies of ore.

Diamond Drills and Supplies

The extensive use of diamond drills has made it advisable for this company to establish a most complete manufacturing plant in which are produced diamond drills in sizes and grades adapted for all kinds of diamond drilling. These may be driven with gasoline, electricity, or steam.

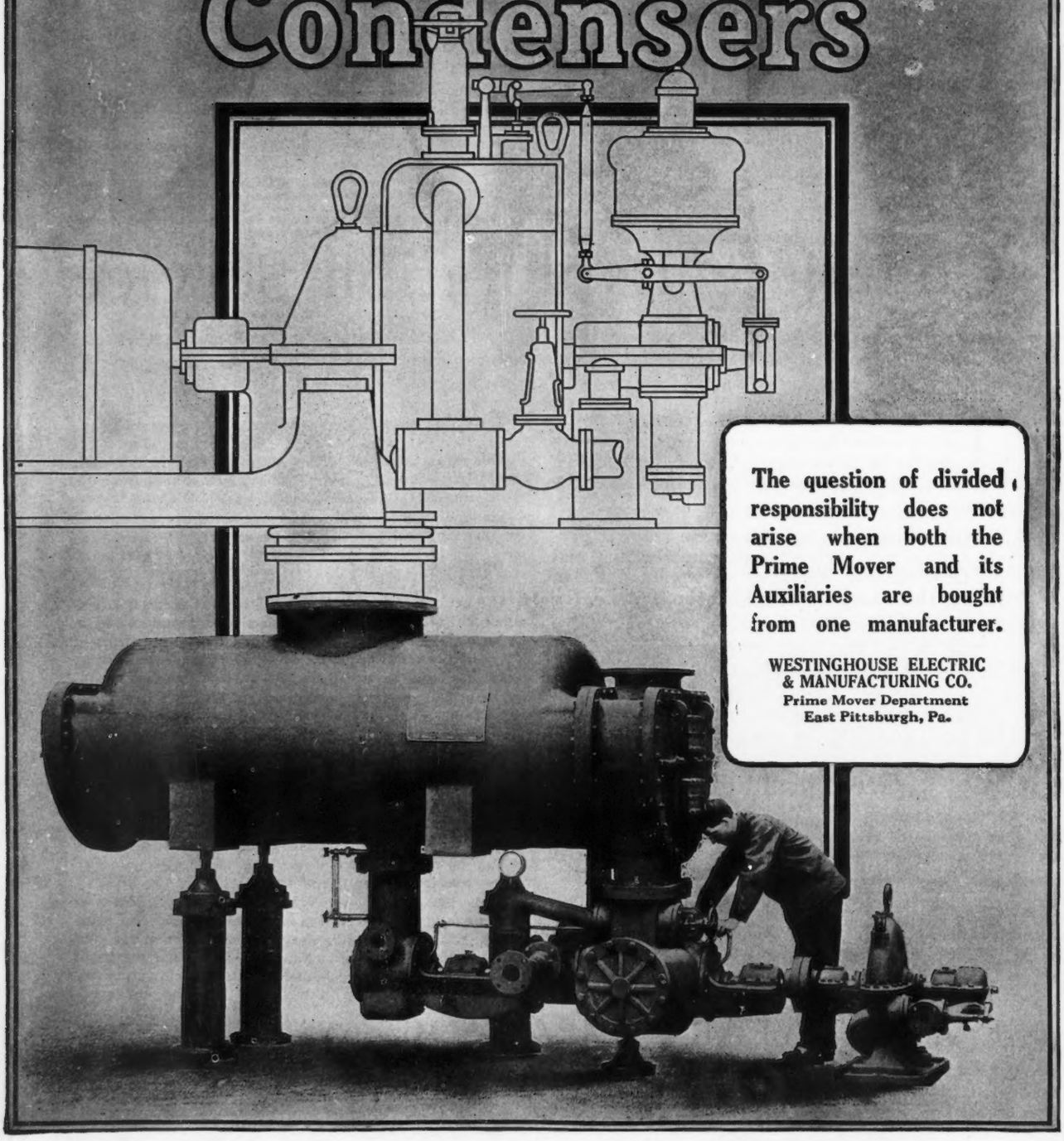
Daily experience with many crews in different formations has enabled the E. J. Longyear Company to perfect Longyear Drills and to advise the proper style of drill for any desired purpose. If you prefer to do your own drilling, the Mechanical Department will sell you the same make of drills and supplies used by the Contract Drilling Department in its own work.

The E. J. Longyear Company advises the employing of the service of any or all of these departments, separately or step by step. In this way you are in a position at all times to estimate the advisability of further procedure.

Each department endeavors to make all estimates in advance, and the officers wish every reader of the Engineering & Mining Journal to feel that they are ready and anxious at all times to give him the best of their judgment in regard to the most economical exploring and estimating of any mining property in which he may be interested.

E. J. LONGYEAR COMPANY, Minneapolis, Minn., U. S. A.

Westinghouse Surface Condensers



The question of divided responsibility does not arise when both the Prime Mover and its Auxiliaries are bought from one manufacturer.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
Prime Mover Department
East Pittsburgh, Pa.

WHEN WE SAY "write nearest branch" we are asking you in a few words to get acquainted with Johns-Manville Service. Our branches are human and alive. They represent Johns-Manville Service and have the "big help" idea before them all the time. We are, as a matter of fact, asking you to use the personal effort of a specialist in your territory who is backed up in his work by a national organization.

Good roofing is like good health—when you've got it, you never have to think about it

J-M Corrugated Asbestos Roofing and Siding may be applied wherever any metal roofing or siding could be used, but it is different from every other corrugated material, because after you put it on, you never again have to think about it. J-M Corrugated Asbestos Roofings have been in service twenty-five to forty years and have never been coated or painted or had any other attention in all that time. That should be conclusive proof of the durability of J-M Corrugated Roofing.

Ralston Steel Car Co., Columbus, Ohio.

J-M Corrugated Asbestos Roofing and Siding is a sheet of corrugated metal, completely enveloped in densely impregnated and thoroughly waterproofed sheets of asbestos fabric, consequently hermetically sealed. It is as nearly everlasting as roofing and siding can be made, for the wearing surface is Asbestos, which is acid and alkali-proof, and practically imperishable. This roofing can be applied directly to wood or steel framing like corrugated iron, but will be still in service long after corrugated iron has rusted out.

Ask our Nearest Branch to give you the Facts, Prices, etc., about this Practically Everlasting Roofing and Siding Material. It Will Pay You to Know.

Read this letter about J-M High Temperature Cement, it's interesting

"We have your letter of the 21st, in regard to our trial of some of your J-M High Temperature Cement.

"We run a very hot fire in our fire box which burns out the fire brick lining very rapidly, and our attention having been called to some of your advertising matter, we tried some of your cement.

"The result more than met with our expectations as the fire box is still in first class shape and is apparently good for some time yet; although if laid with the ordinary fire-clay we should have had to re-lay it long ago." (Signed)

This letter comes from a well-known New England concern. J-M High Temperature Cement is saving money for them because it makes their fire brick last longer. Why not let it do the same for you.

H. W. JOHNS-MANVILLE COMPANY

Manufacturers of Pipe Coverings; Conduit; Metallic Hose; Waterproofings; Mastic Flooring; Stack Lining; Packings.

Akron	Boston	Columbus	Duluth	Kansas City	Minneapolis	Philadelphia	St. Paul	Toledo
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THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD., Toronto, Winnipeg, Montreal, Vancouver. 3141-B

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Positions Open, (Civil Service Examinations), **Employment Agencies** (Labor Bureaus), **Business Opportunities Wanted** (Agents and Salesmen—Contract Work), **Miscellaneous** (Educational—Books), **For Sale**, 5 cents a word, minimum charge, $1.00 an insertion.

Count five words for keyed address care of New York; six for Chicago. Abbreviated words or symbols count as full words.

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No information given by us regarding keyed advertiser's name or address.

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Advertisements calling for bids, $3.60 an inch per insertion.

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MINE MANAGER, experienced in opening and developing new properties, to superintend silver mine; must have milling experience; state experience and salary expected. P. 954, Engineering and Mining Journal.

STOREKEEPER for large smelting plant in Southwest; must be experienced and capable of handling supply accounts; salary, $125 per month. P. 958, Engineering and Mining Journal, Chicago.

POSITIONS WANTED

FLOTATION EXPERT, experienced with various flotation machines; 6 years' experience in mining and milling; technical graduate. P. W. 951, Engineering and Mining Journal, Chicago.

MINE AND MILL SUPERINTENDENT desires position; graduate engineer; 13 years' experience cyaniding, concentration, mine development; excellent testimonials; nominal salary until ability proved; Spanish spoken. P. W. 957, Engineering and Mining Journal, Chicago.

METALLURGIST, specialty flotation; five years' milling and metallurgical work; two years' experimental work with various flotation machines; expert in flotation oils; technical graduate; available about July 15. P. W. 956, Engineering and Mining Journal, Chicago.

METALLURGIST (32) open for engagement; technical graduate; nine years' experience in charge of copper blast furnace, converter and reverberatory work; two years' metallurgical construction with large refinery; excellent references; good executive. P. W. 962, Engineeing and Mining Journal.

MINING ACCOUNTANT—Young man, 32 years old, married, eight years' accounting experience all departments large copper company, can supply forms and systematize; unquestioned Boston and Arizona references; bonds; speak Spanish. P. W. 963, Engineering and Mining Journal, Chicago.

MINING ENGINEER, graduate of M. I. T., eight years' varied mining and milling operating experience; also design and construction of mills and mining plant; desires position with consulting engineers or operating company; excellent references. P. W. 964, Engineering and Mining Journal.

MINING ENGINEER, 28, single, graduate of the University of Texas, wants position with engineering firm in New York or elsewhere; draftsman, assayer, surveyor; speak Spanish; handle labor; salary, locality immaterial; object experience, advancement; best recommendation. P. W. 961, Engineering and Mining Journal.

ASSAYER on zinc and lead ores desires position. P. W. 959, Engineering and Mining Journal, Chicago.

AS RESIDENT MANAGER OR SUPERINTENDENT; experienced in deep placer work, etc.; thoroughly practical in mechanics pertaining to mining operations; good executive; best references. P. W. 960, Engineering and Mining Journal.

BUSINESS OPPORTUNITIES

Wanted—A partner to develop a promising galena-zinc prospect adjoining a dividend payer. Address Lock Box 205, Wallace, Idaho.

FOR SALE, or open for associated capital for further development, the Sedberry Mine, Montgomery County, North Carolina; valuable deposits of free gold, lacking only capital for development of unlimited resources. Write for particulars to D. E. Hammer, High Point, N. C.

FOR SALE

FOR SALE CHEAP to quick purchaser, a Gurley mountain transit with solar attachment, almost unused and in good order. Also No. 2 Decker bullion assay scales, also in good order. Address Hildreth, 12 Bridge St., New York City.

CHINA CLAY LANDS FOR SALE—About 2000 acres in South Carolina. Very extensive deposits. Operated since 1867 by R. McNamee & Co. Well known to trade. Francis B. Fay, Executor, 97 Cedar St., New York.

EIGHT YEARS FURNISHING TECHNICAL MEN.
NEED A SUPERINTENDENT?
— ASSAYER, ENGINEER, MASTER MECHANIC, ELECTRICIAN? —
WIRE OR WRITE
BUSINESS MEN'S CLEARING HOUSE, DENVER, COLO.

THE LARGEST STOCK IN THE WORLD OF NEW AND SECOND HAND MACHINERY READY TO SHIP

YOU WILL SAVE ONE HALF THE COST

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We test Coal & Ore land in any part of North or South America.

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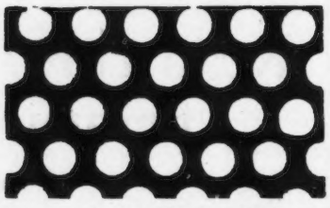
for every purpose



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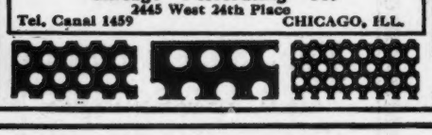

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The Cochise Drill Uses Air Expansively

Fluttering is eliminated and power is saved. From 1000 to 1200 blows per minute can be struck on 60 cubic fet of air.

Steel is used throughout with the exception of the cylinder, which is cast from a composition metal of great toughness and wearing quality. The valve slides in a hardened steel liner.

The "Cochise" allows more drilling per day per drill.

Cochise Machine Company, Los Angeles, California

The Wood Rock Drill

Naturally, we couldn't claim to give you better drill service if the Wood Rock Drill didn't have differences in design and materials of construction. The Vanadium Tungsten iron used in "Wood" Rock Drills is as close-grained as silver. You know how porous cast iron is and the kind of drill service it gives.

Get down to the facts. Send for the "Wood" Catalog.

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Cheaper Cores

drilled frim your mine property to any desired practical depth are certain if you get them with

Dobbins Core Drills

Especially designed to stand up under hard service in remote districts.

Fitted with direct geared spindle and hoist drive, each independent of the other.

Drill head can be swiveled to bore holes at any angle up to 45°.

The machine is always under complete control of the operator. **Write for interesting catalog.**

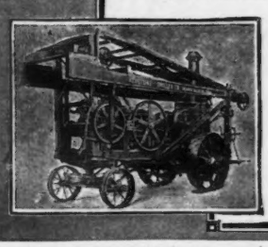
The Dobbins Core Drill Co.
149 Broadway, N. Y.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air, Electricity. **Send for Catalogue No. 5.**

STANDARD DIAMOND DRILL COMPANY
745 FIRST NATIONAL BANK BUILDING, CHICAGO, U. S. A.

KEYSTONE CABLE DRILLS



for Placer Gold Testing, in advance of dredge; Mineral Prospecting for Lead, Zinc, Coal, Copper, etc.; Oil, Gas, and Water Well Drilling; Blast Holes in Cement and Stone Quarries. Equipped with steam engine, gas or electric motors. In writing specify class of work you are interested in.

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Manufacturers of

Rock Drills, Hammer Drills, Core Drills, Pile Hammers, Atlas Jacks.

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Flotation Concentration of Sulphide Ores by means of the Minerals Separation Processes.

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Pumps and Pumping Engines.
Oil Engines and Gas Engines.
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Elevating, Conveying and Power Transmission Machinery

Submit us your requirements and we will furnish plans, with estimates of cost. *Our engineering service always at your disposal.*

The Webster M'f'g Company, Chicago New York **Tiffin, O.**

"JACKSON MADE" PUMPS

A Better Make Not Made

They cost less to buy—less to run and less in repairs. **Write for Catalog No. 20.**

BYRON JACKSON IRON WORKS, Inc.
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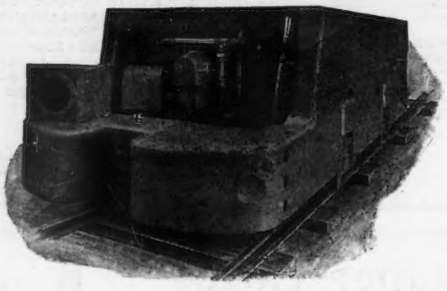
Over 150 Mining Companies

are today using these motors.



THEY have been proved safe, reliable and so economical that no other system can approach them in low initial, upkeep or operating expense. If a 10 to 50% reduction in haulage costs interests you, let us send you our Catalog and Bulletins giving the actual cost figures of a large list of Whitcomb users.

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An Electrically Driven Concentrate Car

No. 150-AE Concentrate Car.

of all steel construction.

ATLAS High Efficiency cars and locomotives.

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Mine Cages, Skips and complete Industrial Railway Equipment.

Let us design a car to meet your requirements.

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"Automobile" Cars

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Whitney Roller Bearing Wheels

"Trucks for cars now in use, or complete new cars, will be furnished equipped with the "Whitney" roller bearing wheels, with the floating automobile type of axle. Your cars will then run from six to twelve months with one greasing, will run with half the haulage power of the ordinary equipment. One man can push 12,000 lbs. on a level track. Cars can run through water or sand without damage to bearings. In use in 1000 mines. All wearing parts, axles, spindles, rollers, wheels, etc., fully guaranteed for one year from date of shipment. Largest ore mines now installing them."

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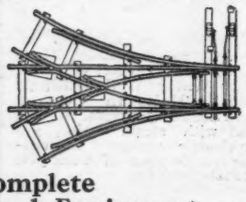
Knoxville, Tenn.

Save in Your Operating Costs

by changing your present track system into a highly efficient one. Our engineering department is ready to help and co-operate in every way. Why not write us today?



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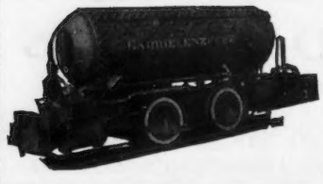
Complete Track Equipment

Everything for the mine track furnished promptly. Write for Catalog.

The Cincinnati Frog & Switch Company, Cincinnati, Ohio



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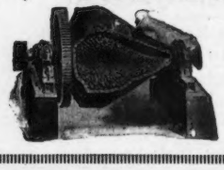

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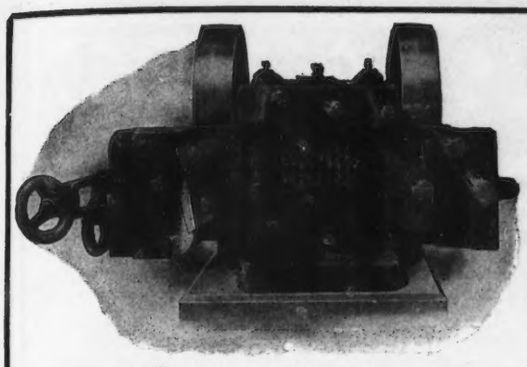

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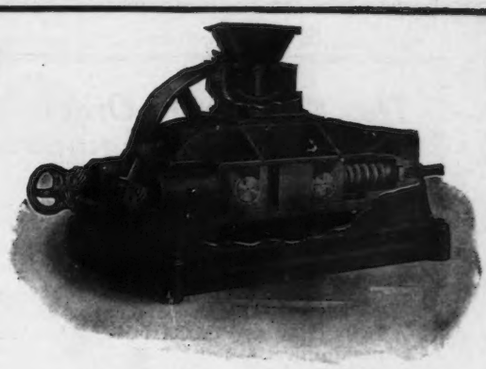

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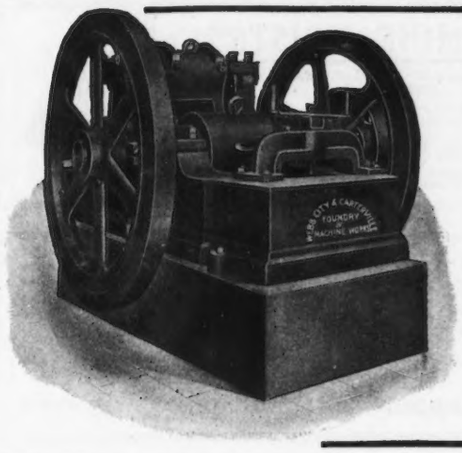

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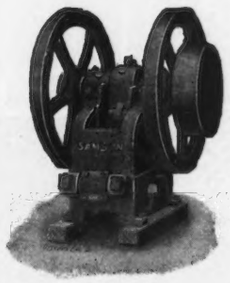

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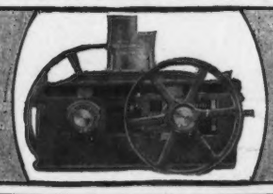

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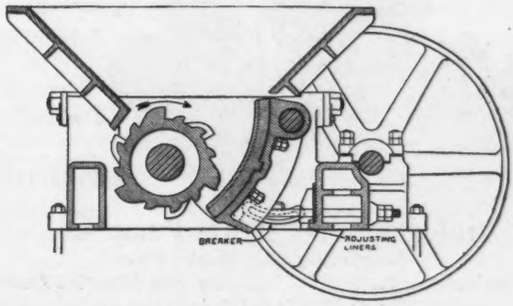

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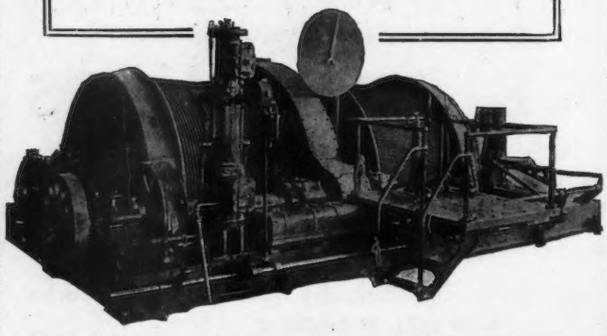

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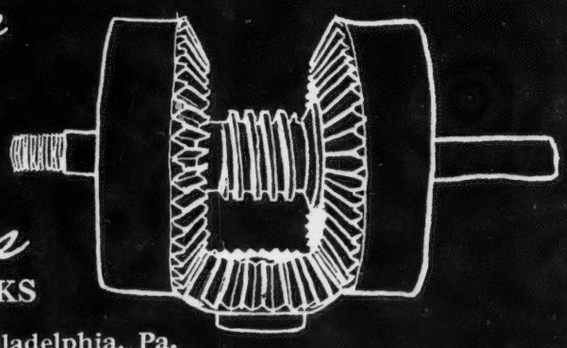

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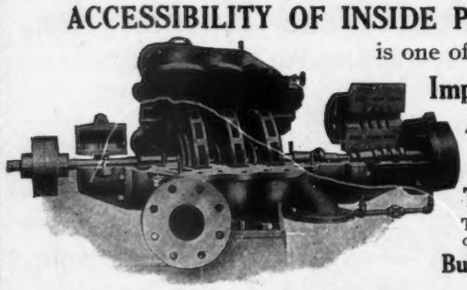

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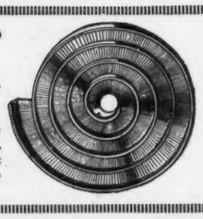

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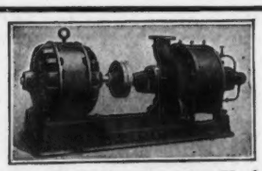

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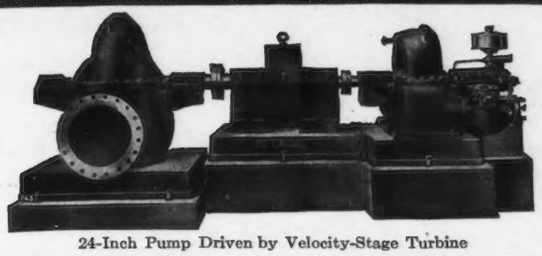

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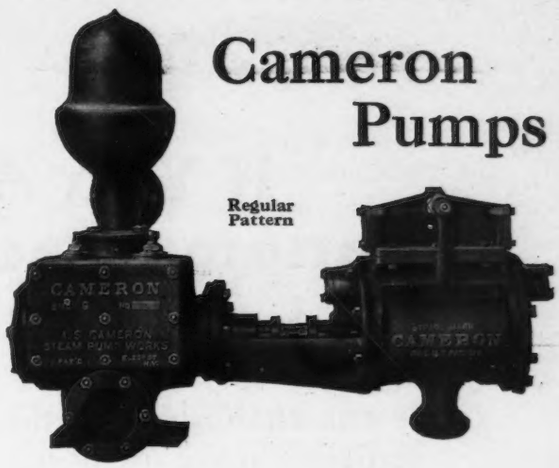

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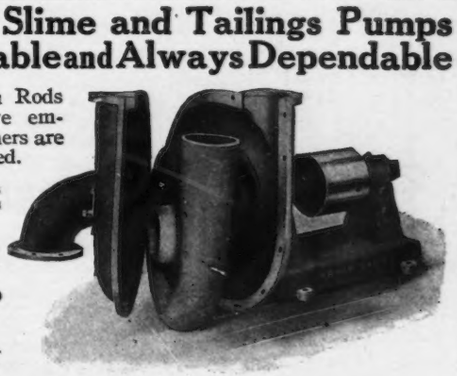

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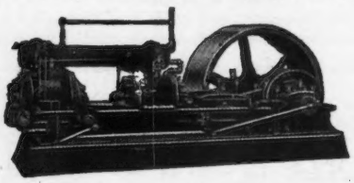

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Burdick, Charles A., Mining Engineer. 74 Broadway, New York. Phone Rector 3536.

Burlingame & Co., E. E., Est. 1866, Assayers and Chemists. Bullion Dealers, Ore Shippers Agent, Ore Testing. 1736 Lawrence St., Denver, Colo.

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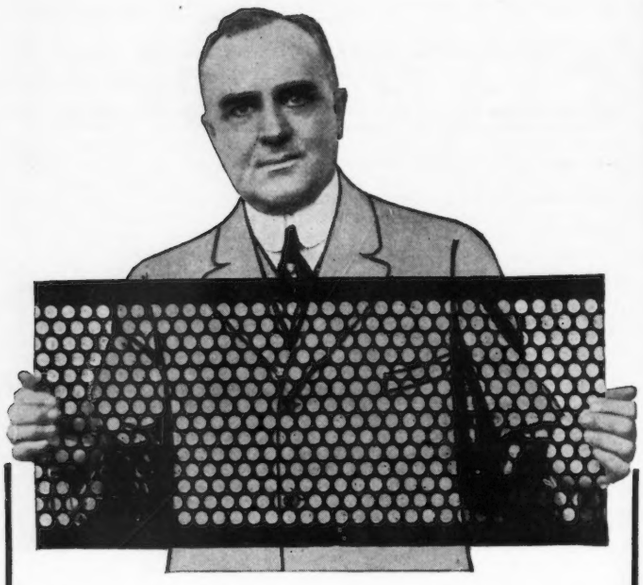

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To withstand acid action. "Acipruf."

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Smooth-On Mfg. Co.—Jersey City, N. J.
In 1-, 5-, 10- and 25-lb. cans.
"Smooth-On" iron cements, metallize, and become part of metal to which applied.

Chains, Transmission

Morse Chain Co.—Ithaca, N. Y.

Webster Mfg. Co.—Tiffin, Ohio.

Chemicals

Roessler & Hasslacher Chemical Co.—New York.

Solvay Process Co.—Syracuse, N. Y.

Classifiers

Colorado Iron Works Co.—Denver, Colo., U. S. A.
"Akins." Five sizes. Capacity varies with material. Self-contained. Inclined trough contains revolving helix.

Deister Machine Co.—Ft. Wayne, Ind., U. S. A.; 562 Salisbury House, London Wall, E. C. London.
Capacity on 60-mesh, 20 tons per 24 hr.
Cast-iron barrel containing staggered inverted, hollow-slotted cones, acting as baffles. Incoming water takes fines to top, coarse material sinking.
Send for Bulletin No. 5.

Denver Engineering Works Co.—Denver, Colo.
Capacities, 250 tons per 24 hr. down.
By settling tank and inclined conveyor, "Ovoca" designed to separate slimes from sands; break up "float"; unwater tailings.
Send for Bulletin 1062.

Dorr Cyanide Machinery Co.—Denver, Colo.

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Bird, Jones & Kenyon—Utica, N. Y.

Compressors, Centrifugal

Ingersoll-Rand Co.—11 Broadway, New York.

Compressors, Portable

Ingersoll-Rand Co.—11 Broadway, New York.

Compressors, Power Drive

Hendrie & Bolthoff Mfg. & Supply Co., The—Denver, Colo.

Ingersoll-Rand Co.—11 Broadway, New York.
"Imperial" and "Ingersoll-Rogler."

International Steam Pump Co.—Laidlaw-Dunn-Gordon Plant. Works: Cincinnati, Ohio. Office: 115 Broadway, New York.
Have "Laidlaw Feather" valves, thin, flexible strips of steel alloy, seating on ground, face-slotted seats, and opening against curved, slotted guards.

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Size to suit work.

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Ingersoll-Rand Co.—11 Broadway, New York.

Nordberg Mfg. Co.—Milwaukee, Wis.

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Deister Concentrator Co., The—Ft. Wayne, Ind. Branches: 1718-1720 California St., Denver; 75 Fremont St., San Francisco.
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Send for catalog.

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Longyear Co., E. J.—Minneapolis, Minn.

Pennsylvania Drilling Co.—Scranton, Penn.

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Designed to meet individual conditions.

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Twelve sizes and types. "Neverleak."
All sizes interchangeable. Made to resist rust and acid. No threads.

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Industrial Works—Bay City, Mich.

Crossings, Railway

Cincinnati Frog & Switch Co.—Cincinnati, Ohio.

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Dixon Crucible Co., Joseph—Jersey City, N. J.

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Buchanan Co., Inc., C. G.—New York.

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McFarlane Mfg. Co., The—33d and Blake St., Denver, Colo.

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Single roll. Wide range of adjustment.

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Robins Conveying Belt Co.—New York.

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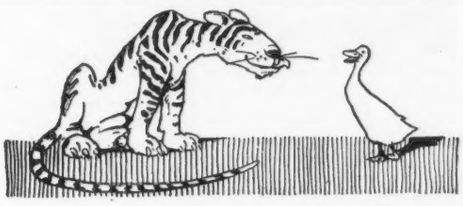

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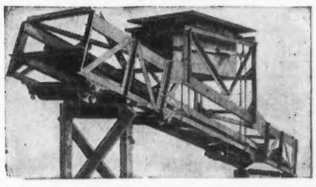

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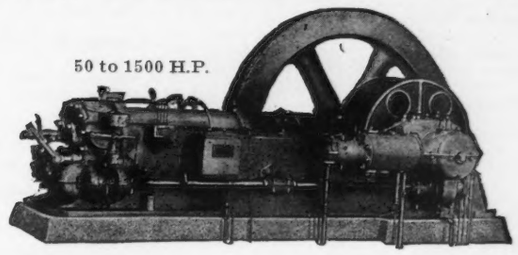

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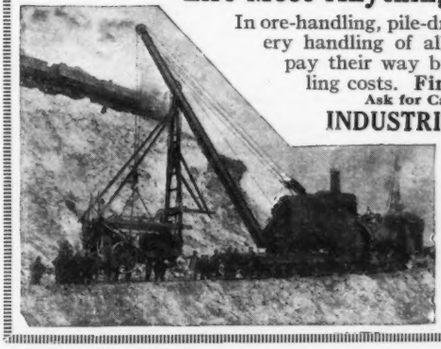

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Any size or for any depth.
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All sizes.
Plain and wire wound in stock.
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Lever water feed to reduce carbide used.
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All sizes; 18 Baldwin and Zar styles.
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General Electric Co.—Schenectady, N. Y.
All sizes.

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"Monel" metal. Tough acid-resisting alloy. Rods, flats, castings, sheets, strips and wire.

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All sizes and capacities.
Complete equipment.
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One cam raises stamps around central shaft.

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Agents: L. Vogelstein & Co., 42 Broadway, New York.
Appelbaum, Inc., M. E.—55 Liberty St., New York.
Arizona Copper Co.—Clifton, Ariz.
Balbach Smelting & Refining Co.—Newark, N. J.
Bartlesville Zinc Co.—52 Broadway—New York.
Beer, Sondheimer & Co.—61 Broadway, New York. Branch: 1101 Newhouse Bldg., Salt Lake City, Utah.
See advertisement.
Blackwell, Sons & Co., Ltd., Geo. G.—The Albany, Liverpool, England.
Consolidated Mining & Smelting Co. of Canada, Ltd., The—Trail, British Columbia.
Ducktown Sulphur, Copper & Iron Co., Ltd.—Isabella, Tenn.
Granby Mining & Smelting Co.—Suite 1710, Third National Bank Bldg., St. Louis, Mo.
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Illinois Zinc Co.—Peru, Ill.
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Nichols Copper Co.—25 Broad St., New York.
See advertisement.
Pass & Son, Ltd., Capper—Bristol, England.
Pennsylvania Smelting Co.—Pittsburgh, Penn.
Phelps, Dodge & Co.—New York City.
Philipp Bros.—42 Broadway, New York.
St. Joseph Lead Co.—61 Broadway, New York.
United Metals Selling Co.—42 Broadway, New York. European Agents: C. S. Henry & Co., Ltd., 12 Leadenhall St., London, E. C.; United Metals Selling Co., G. M. B. H., Unter den Linden 56, Berlin, Germany.
See advertisement.
United States Smelting, Refining & Mining Co.—55 Congress St., Boston, U. S. A.—Works: Midvale, Utah; Needles, Calif.; Gold Road, Ariz.; Kennett, Calif.; Chrome, N. J.; Grasselli, Ind.; Pachuca and Real del Monte, Mexico.
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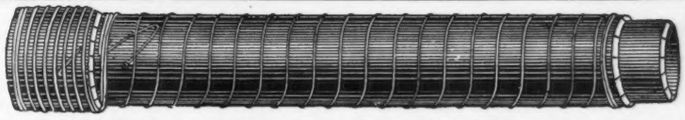

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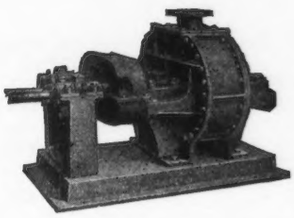

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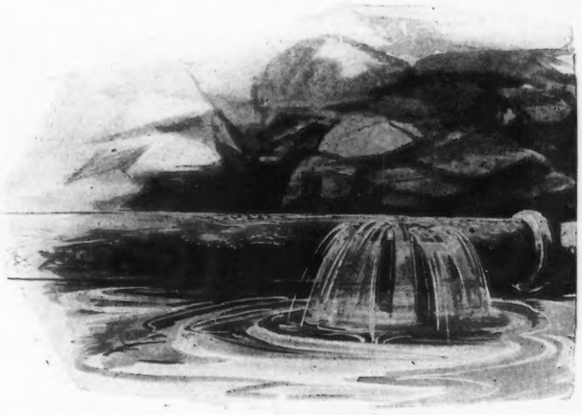

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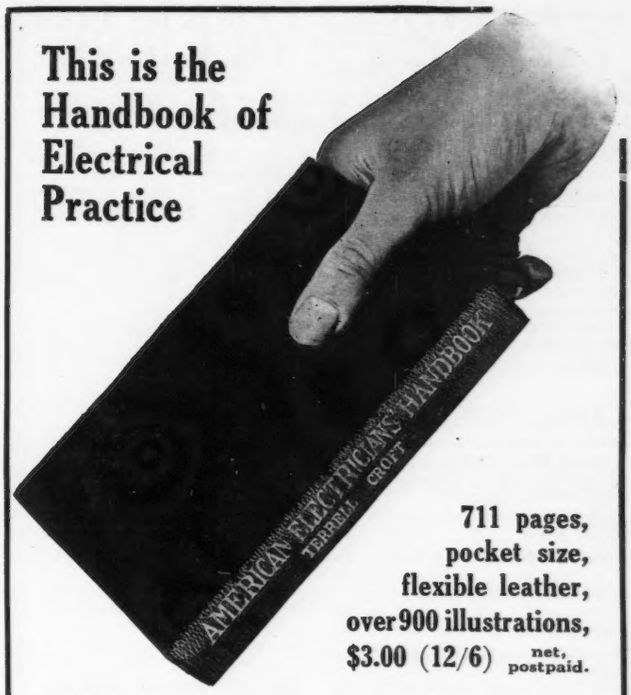

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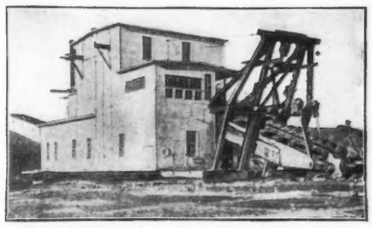

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